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NASA
National Aeronautics and
Space Administration

Announcement of Opportunity

SPACE STATION ATTACHED PAYLOADS

COMPLETED

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Letters of Intent Due: August 19, 1988
Preproposal Conference: August 25, 1988
Huntsville, Alabama
Proposals Due: November 14, 1988

ORIGINAL

SPACE STATION ATTACHED PAYLOADS

ANNOUNCEMENT OF OPPORTUNITY

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PREFACE

The National Aeronautics and Space Administration (NASA), following a 1984 directive from the President, initiated a program to create a permanently manned Space Station. Preliminary design studies for a Space Station began in 1985, and major integration and hardware contractors were selected in 1987. Assembly of the Station in space is scheduled to begin in 1995 and to be completed in 1997. The Space Station is expected to have an operational lifetime of over 30 years. It will be available during its lifetime as a recurring opportunity for space science and applications investigations.

This Announcement of Opportunity (AO) is directed specifically to soliciting proposals for externally attached payloads that can operate productively during the assembly phase of the Space Station and for concept studies of attached payload investigations and facilities to be flown after the completion of assembly. Flight proposals for investigations that require more support than will be available during the assembly phase should not be submitted at this time. The first capability for mounting attached payloads to the Space Station is expected to be available in 1995. Space Station utilities to support attached payloads are described in Appendix A. Proposers should note that the Space Station Program has just entered its detailed design and development phases. The descriptions in Appendix A, while correct in general terms, are incomplete and are likely to change in detail. The information in Appendix A is the most accurate information currently available.

THIS IS A VERY LIMITED OPPORTUNITY IN WHICH NASA EXPECTS TO SELECT ONLY 4 TO 6 INVESTIGATIONS FOR FLIGHT AND 6 TO 8 INVESTIGATIONS FOR STUDY. This AO is the first of an expected series of opportunities to propose attached and other types of investigations for the Space Station.

I. DESCRIPTION OF THE OPPORTUNITY

In order to provide for the timely selection, development, and accommodation of attached payloads to fly on the Space Station during the assembly phase, to help define Space Station payload support capabilities, and to assure the availability of excellent scientific and applications investigations for the operational phase of the Space Station, NASA announces, at this time, the opportunity to propose investigations for the Space Station. This Announcement of Opportunity (AO) invites proposals in two categories: (1) proposals for early attached payload flight investigations and proposals to use facilities provided by NASA during the assembly phase; and (2) proposals for concept studies of more demanding investigations and facilities for flight on the Space Station after completion of the assembly phase. [For purposes of this AO, the distinction is made between a Principal Investigator (PI) investigation and a facility. A PI investigation is an experiment or study conceived and proposed by an individual who is responsible for carrying out the investigation and for reporting the results. A facility is an instrument or group of instruments provided by NASA to satisfy a general objective or need and which is made available to a number of investigators who conduct focused studies through the use of the facility.] This AO does not constitute an obligation on the part of the Government to carry the proposed effort to completion.

The opportunities described in this AO are limited to the scientific and applications disciplines of astrophysics, communications technology research, life sciences, solar system exploration, and space physics. Investigations in the Earth sciences have been solicited under AO No. OSSA-1-88 for the Earth Observing System (EOS), released in January 1988. The evaluation of proposals for Space Station attached payloads in the Earth sciences that are received under AO No. OSSA-1-88 will be coordinated with the evaluation of proposals received under this AO. Proposals in the category of small attached payloads that are not in the Rapid Response Research (Quick Is Beautiful)* category are welcome. Attached payloads will be considered for grouping at one attach point, and the ability of a particular instrument to function in such a configuration will be considered

* Rapid Response Research, also called "Quick is Beautiful", is a category of research activities characterized by investigations of small to moderate sized instrumentation that can be brought from acceptance of proof of concept to flight and return of data in a period of 2 to 3 years or less. NASA is developing provisions and implementation procedures to facilitate Rapid Response Research opportunities on the Space Station.

in the proposal selection. The Multiple Payload Adapter, which will be used to carry the grouped payloads is described in the Users Guide for Space Station Attached Payloads, available to persons who submit letters of intent to propose or who attend the preproposal conference.

Investigations to be carried out in the pressurized modules or to use external accommodations other than those provided for attached payloads on the U.S. elements of the manned base, such as the Plasma Interactions Monitoring System, or the exposed facility on the Japanese Experiment Module; and the Rapid Response Research payloads will be solicited separately and will not be considered under this AO.

An analysis of available Shuttle lifting capability, Space Station power, and the number of serviceable attach points has led NASA to conclude that 4 to 6 investigations can be selected for flight during the assembly phase. These operational limitations, funding limitations, and the desire to avoid a long queue of investigations in definition has led NASA to conclude that only 6 to 8 investigations will be selected for concept study. Proposers should recognize the limited nature of the opportunity described in this initial AO. NASA intends to provide additional opportunities to propose both flight investigations and concept studies for post assembly phase attached payloads via subsequent solicitations.

A. Flight Proposals

This AO invites flight proposals for investigations appropriate for exposure in space during the assembly phase of the Space Station (1995-1997). These investigations must have modest demands on Space Station characteristics or resources, such as crew time, pointing stability, or sensitivity to contamination. NASA is also considering, during the assembly phase of Space Station, the deployment of the Astromag cosmic ray facility and the Cosmic Dust Collection Facility (CDCF). Proposals to provide ancillary instrumentation for these facilities are also invited under this AO. The NASA decision whether or not to proceed with these facilities will depend on the scientific merit of proposals for the use of the facilities viewed in the broader context of the scientific merit of all investigations proposed under this AO.

Brief descriptions of the Astromag facility and the CDCF and identification of points of contact for additional information are contained in Appendices B and C. Detailed descriptions of the facilities will be provided to persons requesting them at the preproposal conference or in their letters of intent.

Because the payloads selected for flight under this AO will be flown during the assembly phase of the Space Station, they must be available on a schedule fixed by Space Station assembly. Preference will be given to investigations that have had extensive design and development, which are reasonably certain to be available on the Space Station schedule, and which will remain within the agreed upon budget. Preference will also be given to investigations that are well suited to operate effectively with the limited resources available during the Space Station assembly phase. During the early part of the assembly phase, the Space Station will not have a permanent crew on board. Investigations selected for this period in the program will be deployed by the Space Station assembly crew, but following deployment, the instrumentation must operate largely in an automated or remotely controlled mode with minimal crew support. Additional information on the Space Station and attached payload accommodations is given in Appendix A.

B. Concept Studies

Proposals will also be accepted for the study of concepts for attached payload investigations and facilities for later deployment on the Space Station. Investigations proposed in this category should concentrate on a description of the scientific or technical objectives of the investigation or facility. The proposed concepts can be designed to take full advantage of the total complement of Space Station resources available for attached payloads at the completion of the assembly phase. Selection for concept study does not imply any commitment by NASA to select the investigation for flight. It is expected that the proposers, whose investigations have been chosen for study will have to respond to further announcements of opportunity in order to obtain a Space Station flight assignment. Investigators, whose proposals are selected for study, will be expected to work with the Office of Space Station to aid definition studies of Space Station payload accommodations.

Interested investigators can also propose facility concept studies for Space Station. In addition to the proposal requirements given later in this Announcement, investigators proposing facility concept studies should list the complete study team. NASA reserves the right to select only part of a facility proposal or team, or to add to the team, if deemed necessary by NASA for scientific or programmatic reasons.

Each concept study team selected under this AO will be required to submit a detailed report at the conclusion of the study that will discuss all aspects of the proposed concept. The final report will include a statement of the scientific goals and objectives of the concept, a conceptual design of an instrument or facility that will accomplish the objectives, and evidence of its feasibility. The studies should cover the instrumentation,

Space Station interfaces and requirements for Space Station support, operations, and data analysis. The report will contain sections on management approach for implementation and cost estimates for the investigation or facility, supported with adequate detail to evaluate the validity of the estimate.

Proposers of facility concept studies should realize that responses to this AO and the subsequent concept study activities will not be permitted to prejudice or constrain NASA in further developing and procuring these facilities. At the end of the concept studies, the study teams will be disbanded. NASA may use the results from the concept studies to initiate further detailed definition study and development, however, the selection of participating investigators and facility developers will be made entirely separate from the selections made under this AO. Hardware contractors participating in the concept studies should understand that NASA will not restrict future hardware options or suppliers to those proposed or developed during the concept studies and that NASA will evaluate all possible sources and may employ standard procurement procedures to acquire facility hardware and support.

II. ANNOUNCEMENT OBJECTIVES

A. SCIENTIFIC OBJECTIVES

The objectives of the Space Station Attached Payload flight opportunity are to advance knowledge in the scientific disciplines of astrophysics, communications technology research, life sciences, solar system exploration, and space physics by conducting scientific investigations on the Space Station in its assembly phase and by conceptually defining investigations of great scientific merit that can use the Space Station as a scientifically productive observing platform. The goals of the individual scientific disciplines for using the attached payload mode of the Space Station are discussed in the following paragraphs.

ASTROPHYSICS

The goal of the NASA astrophysics program is to understand the origin of the universe; the laws of physics that govern it; and the nature and evolution of galaxies, stars, and the planets. Celestial objects frequently radiate energy in several wavelength regions from radio waves to gamma rays, and, in order to achieve the goals of the astrophysics program, it is necessary to observe at all wavelength bands of the electromagnetic spectrum. This is not possible from the surface of the Earth where all but a small region of the electromagnetic spectrum is absorbed by the atmosphere. Because of the inherent limitation on astronomical

observations from the Earth's surface, the astrophysical sciences have benefited immeasurably from the ability provided by space technology to observe above the atmosphere. The advances of space technology have made possible major advances in the classical fields of astronomy by providing new understanding of such phenomena as the formation of stars, and have opened up entirely new branches of observational astronomy that observe infrared, ultraviolet, x-ray, and gamma radiation from celestial objects.

The Space Station will serve the astrophysics community in three different ways: as an observing platform, as a servicing facility, and as an assembly facility. Servicing and assembly will be possible in later phases of the Space Station program. Phase I, however, lends itself well as an astronomical observing platform for attached payloads. Instruments that do not require pointing, that require only modest resources, or that can use the moderate stability of the Payload Pointing System (PPS) are particularly appropriate for the early Space Station. [See Appendix A for the characteristics of the PPS.] Scientists who have developed instruments that can address the astrophysics program's scientific objectives from the Space Station are invited to propose them under this AO.

COMMUNICATION TECHNOLOGY RESEARCH

The advanced communication programs under way in OSSA encompass the disciplines of both radio frequency (RF) and optical communications. These research programs have as their focus the development of the high-risk microwave, optical, and digital technologies needed to support NASA's future missions. These advanced communication technologies will (1) enhance new science through increased data gathering and processing capability; (2) enable future near Earth and deep space exploration missions utilizing advanced communications technology to achieve such improvements as telepresence and, therefore, telescience; and (3) reduce the adoption risk on the part of industry of this technology so as to improve the United States' competitive posture in the world marketplace.

A key element of the communication program in the RF regime is the development of large antenna technology. The primary concerns are with the erection and testing of these items in the gravity free environment. In the optical regime, NASA is concerned with the optical antenna technology; precision structures; nanoradian alignment, pointing, and tracking; astrometric navigation (star tracking); as well as the maintenance and operation of optical oscillators (laser) in the space environment. The goal of the communication program is to understand the performance limitations which the space environment places on this technology and to incorporate this knowledge into future systems.

The Space Station will serve the communications community in three ways: (1) as a test facility for advanced communication concepts , such as optical communication systems and related technologies and RF communications systems that utilize large antennas or antenna arrays (10 to 100 m), that cannot be tested on Earth; (2) as an assembly and staging facility for the large antennas that can neither be assembled on the ground because of gravitational effects nor transported into space erected because of size; and (3) as a performance demonstration facility to support the transfer of NASA developed technology to private industry, eliminating the perceived adoption risk. Organizations that have developed systems or technologies that can address the communication and information systems program objectives for the Space Station are invited to propose them under this AO.

LIFE SCIENCES

The goals of the NASA life sciences program are to understand the origin, evolution, and distribution of life in the universe; to understand the relationship between life and gravity and other planetary properties; and to develop medical and biological capabilities that enable the human exploration and habitation of space. Major scientific and technical objectives for the life sciences program on Space Station are to: understand the physiological, sociological, and psychological implications of spaceflight and return to a gravity field; develop appropriate medical and bioregenerative life support technologies to enable human expansion into the solar system; understand the effects of gravity on the life cycles of animals and plants; characterize the combined effects of microgravity and other environmental stresses on biological systems; determine how biological and planetary processes interact; and trace the history of biologically important molecules from synthesis to assimilation into planetary and living systems.

The primary life sciences Space Station research base will be located in the pressurized modules. However, attached payload observations of biologically important elements and compounds in space and from other planets will permit exploration of the relationship between the evolution of life and the universe (exobiology).

The collection of interplanetary and interstellar dust particles (IDP's) offers particular promise for the direct measurement of organic molecules of biological significance. Captured dust grains can be analyzed to determine whether the dust is cometary, meteoritic, or interstellar in origin. IDP's will provide important new evidence concerning the role of biogenic elements and compounds in planetary evolution leading to the origin of life. These investigations form a subset of the NASA Cosmic Dust Collection Facility described in Appendix C.

Orbiting telescopes on Space Station in the wavelength range from far infrared to the submillimeter region can provide unique and previously unavailable information about molecules in diverse cosmic environments. The detection of extra-solar planetary systems, the study of material from the primordial solar nebula, and the identification of biogenic elements and complex molecules in primitive bodies and in the atmospheres of the giant planets, comets, and asteroids will all contribute to the understanding of the origin, evolution, and distribution of life and life related materials throughout the universe. Scientists interested in proposing a telescope as an attached payload should see Appendix A for a description of the Payload Pointing System that will be available in the early phases of the Space Station program.

SOLAR SYSTEM EXPLORATION

The primary goals of the solar system research program are to understand the origin, evolution, and present state of the solar system, to gain a better understanding of the Earth by comparative studies with the other planets, and to understand how the appearance of life relates to the chemical and physical history of the solar system. A secondary goal is to survey the resources available in near-Earth space in order to develop a scientific basis for future utilization of these resources.

The major thrust of the solar system exploration program is carried out through a series of planetary orbiters and probes to map the surfaces of planets such as Venus, to rendezvous with comets and asteroids, and to image and sample the atmospheres of the planets and their satellites. These major missions are complemented by Earth orbiting and ground based studies. The Space Station offers particular opportunities to search for extra-solar planetary systems using telescopes or other appropriate instruments mounted to the Space Station and to collect interplanetary and cometary dust in the orbit of the Space Station.

Cosmic dust investigations are particularly appropriate for the early Space Station. For example, instrumentation which can measure orbital parameters of individual dust grains and which can capture individual grains for subsequent mineralogical, chemical, isotopic, and, if possible, organic analysis would be of major scientific interest. A Cosmic Dust Collection Facility (CDCF) is planned for implementation as an attached payload on the Space Station. The CDCF is described in Appendix C. Proposals to use the CDCF are invited under this AO.

SPACE PHYSICS

The space physics program supports research in space plasma physics, galactic cosmic rays, solar physics, heliospheric physics, magnetospheric physics, ionospheric and upper atmospheric physics, and solar-terrestrial physics. The goal of the space physics program is to understand the physical processes taking place in these regions of space. Specifically, a research goal in space plasma physics is to understand space plasmas in their natural environments by actively stimulating processes of interest and making measurements of the results in the near-Earth environment. Results are expected to contribute to a better understanding of the solar wind plasma, wave-particle and plasma-field interactions, and interplanetary shocks and interaction regions found throughout the heliosphere and the nearby interstellar medium.

In addition, there is extensive scientific interest in understanding the Sun's interior, photosphere, chromosphere, transition region, corona, global circulation, sources of energy, and composition. There also is interest in the storage and release of solar flare energy; in the generation and release of energetic photons and particles in the Sun; in understanding the composition, acceleration, and transport of solar energetic particles; and in the energy flow and particle transport throughout the solar system, especially into the Earth's upper atmosphere.

Galactic cosmic rays provide information on the nucleosynthesis of the elements and the effects of the relativistic particle plasma on the dynamics and evolution of the galaxy. Therefore, an understanding of the origin, acceleration, and interactions of galactic cosmic rays as well as the identification of exotic particles, antimatter, and dark matter candidates in the galactic cosmic ray flux are also goals for space physics investigations.

The formation of magnetospheres of the Earth and other planets and satellites is another area to be studied in space physics research. This includes cometary magnetospheres and the comparison of various magnetospheres and plasma interactions in magnetospheres. Thus, the understanding of the formation, structure, and dynamics of planetary ionospheres and aurora, and atmosphere-ionosphere-magnetosphere coupling in the terrestrial magnetosphere, as well as in the magnetosphere of other planets, are all research goals of space physics.

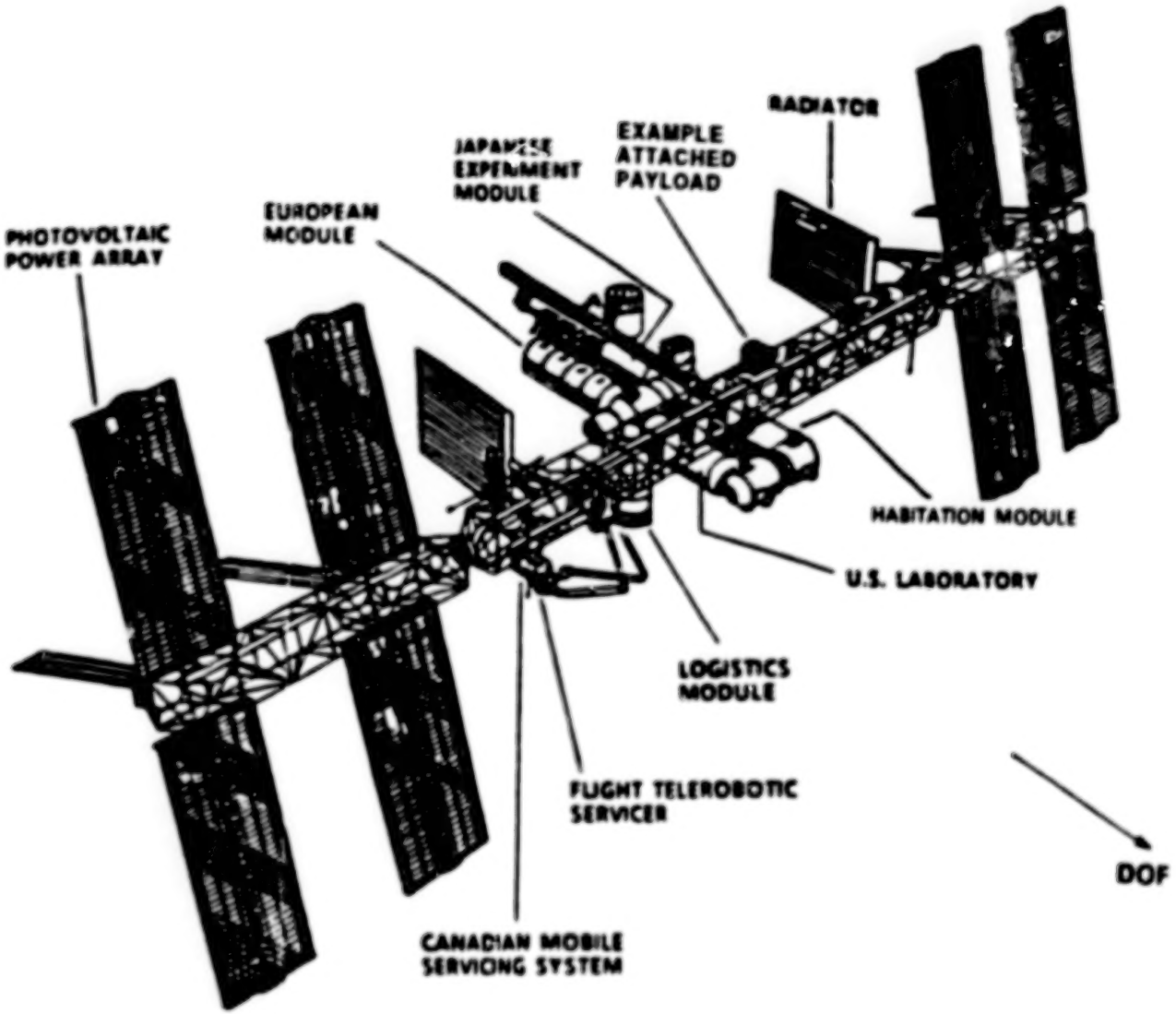
The attached payload mode of operation on the Space Station is particularly attractive to investigations of the ambient plasma environment. The Space Station will be a large body of heretofore unprecedented size traveling through the ambient space plasma. The large solar panels, long trusses, and off-gassing effluents which become ionized, will create a continuously varying plasma environment. The understanding of the plasma

environment is of importance both for its purely scientific value as well as for the effect that the plasma sheath can have on the operation of other instruments and facilities.

Galactic cosmic ray investigations are ideally suited to the observational opportunities offered by the Space Station. The main operational requirement for the instruments is anti-Earth viewing, so they are readily accommodated on the early Space Station. The Astromag facility described in Appendix B is enabled by the servicing ability of the Space Station to exchange scientific instruments and to provide cryogenic resupply after a few years of initial operation. By augmenting the superconducting magnet at the core of the facility with a variety of specialized state of the art detectors, issues of central importance in investigations of cosmic radiation can be addressed: e.g., the origin and evolution of matter in the galaxy, the search for antimatter and dark matter of cosmological significance, and the origin and acceleration of relativistic particles in the galaxy. With its capability for measuring the charge, mass, and energy spectra of charged particles with unprecedented precision and sensitivity, Astromag will complement the Great Observatories measurements of electromagnetic radiations.

III. BACKGROUND

Construction and assembly of the first phase of the Space Station is expected to begin in 1995 and is currently planned to be completed in 1997. Facilities for attached payloads are expected to be available in 1995. At the completion of assembly, the Space Station will carry a crew of 8 persons. It will include a U.S. laboratory module, a habitat module, and accommodations for attached payloads. Canada, the European Space Agency, and Japan will also participate in the Space Station. Canada will provide a mobile servicing system and the European Space Agency and Japan will each provide laboratory modules. Power will be provided by solar arrays. Figure I shows the baseline configuration of the Space Station at the completion of its assembly and outfitting phase. Four attach points with full utility services for payloads will be available at the end of this phase. An example of an attached payload is shown in the figure. It may be possible to attach small payloads elsewhere on the structure if no utilities other than power and data lines are required. Information on Space Station characteristics and attached payload accommodations is given in Appendix A and in the Users Guide for Attached Payloads. Proposers must specify in their proposals their assembly and servicing requirements. The nature of on-orbit servicing capabilities to be available during and immediately after the assembly phase has not yet been determined, but will be very limited.



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The time-line of Space Station construction and activation is subject to change as assembly requirements become better understood. If time is not available to attach and activate all attached payloads carried to the Space Station on a specific flight, it may be necessary to store a payload in an inactive mode at the Space Station. Proposers should be aware that their payloads could be stored in a dormant condition at the Space Station for 90 days or longer. Proposers should state in their proposals the provision they will make for such a contingency and their requirements for thermal blankets, heater power, etc.

All attached payloads will be transported to and from the Space Station aboard the Space Shuttle. The payloads must, therefore, meet the environmental, launch, and safety requirements of the Shuttle as defined in NASA-JSC 07700, Volume XIV, and Attachment 1 (ICD 2-19001). Minimal Shuttle support utilities will be available during the transit flight to and from the Space Station. Proposers should make provision to provide their own self contained heaters, gas supplies, etc. that are required to support their instrumentation up to activation. Shuttle cargo bay attachment fixtures and packaging required for transportation will be provided by NASA. Unique packaging required for environmental control or instrument integrity are the responsibility of the proposer and should be considered in the proposal. Proposers should also recognize that Shuttle launch procedures may require unattended stowage of instrumentation in the Shuttle launch preparation area and cargo bay for several days. Proposers should specify any special requirements for stowage during this period.

IV. PROPOSAL OPPORTUNITY PERIOD

Proposals for flight and for concept studies must be received at the address listed in Section VIII no later than 4:30 p.m. Eastern Time, November 14, 1988. NASA may later amend this AO to provide for subsequent dates for submission of proposals if warranted. A preproposal conference will be held on August 25, 1988, at the NASA Marshall Space Flight Center, Huntsville, Alabama and letters of intent to propose are due at the address given in Section VIII by August 19, 1988. Additional technical information on the Space Station and the Attached Payload Program and proposal preparation information will be provided to persons attending the preproposal conference or submitting letters of intent to propose.

V. SUPPLEMENTARY PROPOSAL PREPARATION INFORMATION

The information contained in paragraphs VI through IX of this Announcement supplements or modifies the information contained in Appendices D and E, General Instructions and Provisions and Detailed Guidelines for Proposal Preparation, extracted from NASA Federal Acquisition Regulations Supplement (NFS) 18-70, and is applicable only to this Announcement.

VI. REQUIREMENTS AND CONSTRAINTS

The Space Station Attached Payload program is intended to provide the first of numerous opportunities to conduct investigations of high scientific and applications priority using the Space Station as an observing platform. Investigations selected for flight during the assembly of the Space Station must adhere closely to schedules and requirements developed by the Space Station program. Therefore, strict requirements will be implemented during proposal selection regarding scientific and technical maturity, cost, and development schedule. Evaluation criteria are listed in paragraph IX. To ensure that instrumentation is compatible with all cost, schedule, and technical requirements, the investigations selected for flight under this Announcement will be implemented in two phases. The first phase will be for a definition study to establish compatibility with the Space Station, Space Station schedules, validity of cost estimates, and availability of Space Station facilities. The second phase will be for development, flight operations, and data analysis.

NASA will reevaluate the scientific, technical, and cost status of each investigation before proceeding into development. Peer evaluation may be used to aid in the evaluation process prior to beginning the developmental phase. Proposals for flight on the Space Station submitted in response to this AO must cover the entire program, including both phases, and should be based on the best available data, including that contained herein. Where appropriate information is not provided, clearly state the assumptions or the requirements.

Proposals submitted for concept studies should also cover the entire program, to the extent possible at the current stage of understanding of the investigation.

Proposers are advised that candidate investigations for the Space Station can come from many sources. These sources include those selected through the Announcement of Opportunity process, those generated by NASA in-house research and development, and those derived from contracts and other agreements between NASA and external entities.

VII. COST PROPOSAL ASSUMPTIONS

1. Flight Proposals

For purposes of preparing the cost section for flight proposals, the following schedule should be assumed:

Proposal Selection:	April 1989
Contract Initiation and Beginning of Definition Study:	July 1989
Completion of Definition Study and Beginning of Development:	January 1991
Complete Development and Begin Space Station Simulated Integration, Test, and Verification:	January 1994
Ship to Kennedy Space Center:	October 1994
Payload Processing and Launch Preparation:	October 1994 to July 1995.
Launch:	July 1995

Proposers should budget for the delivery of one flight article and one engineering model of their instruments. The engineering model must be identical to the flight article in all respects except that it need not be built with flight qualified parts. By submitting a flight proposal, the investigator's institution agrees that if the proposal is selected, it will be required to comply with the Space Station flightworthiness requirements for attached payloads. This must be accomplished by the organization managing the acquisition of the equipment. Flightworthiness requirements will be those to ensure necessary flight safety and those to ensure a reasonable probability of satisfactory mission performance of the experiment equipment (reliability and quality assurance). Investigators selected to provide flight instrumentation will be advised by the NASA Contracting Officer shortly after selection of the pertinent flightworthiness requirements. For proposal costing purposes, assume flightworthiness requirements equal to those for Space Shuttle attached payloads given in NASA Handbook NHB 1700.7A.

The management of the definition and development of flight investigations will be assigned to an appropriate NASA field center. For purposes of uniformity in cost estimating, and until management center assignments are made, proposers should estimate their travel costs to Washington, DC. Flight investigation proposers should assume that five trips of two days each to

Washington, DC, will be required during the definition phase and that three trips of three days each will be required annually during the development phase. Assume, in addition to other staff requirements, that one engineer full time equivalent will be required at the NASA Kennedy Space Center, Florida, during payload integration, test, verification, and prelaunch payload processing.

Space Station payloads will be operated in time units called increments. These units are the time intervals between Shuttle visits, and will vary from about 90 days early in the early permanently manned phase to a target of 180 days by the end of the assembly phase. Proposers of flight investigations should state in their proposals the length of space exposure time required to accomplish the objectives of their investigation. The availability of exposure time during the assembly phase in comparison to that requested will be considered in proposal selection. Proposers should assume, for purposes of the cost proposal, that the requested time will be available and the payload operations budget should be based on the size of the operations staff extended over the time required to accomplish the objectives of the investigation.

All flight proposals must include a discussion of the data reduction and analysis plan. The Space Station attached payloads will be operated through the Payload Operations Integration Center (POIC) located at the NASA Marshall Space Flight Center, Huntsville, Alabama. Interactive payload planning and real time access will be available through the POIC. Operations of payloads from regional centers or from the investigators home institution (telescience) may be considered at a later time and should not be baselined in the proposal. Proposers should specify and justify in their proposals their requirements for real time access to payloads.

Investigators should include a schedule for the delivery of the reduced data from their instruments to a national repository, where the data will be made available to other users. For planning purposes, assume that cosmic dust data will be archived at the NASA Johnson Space Center, Houston, Texas, and all other data at the National Space Sciences Data Center, Greenbelt, Maryland.

2. Concept Study Proposals

Proposers of concept studies should assume that the studies will begin December 1989 and continue for three years. Selected proposals will be funded initially for one year at a level of between $100,000 to $400,000. Additional funding in subsequent years will be determined by the progress made during the first year of study and by the availability of additional study funds. Management of each Attached Payload concept study will be assigned to an appropriate NASA field center. For uniformity in estimating travel costs, proposers should assume that the studies will be managed in Washington, DC, and should budget three trips of two days each, annually, to Washington.

VIII. PROPOSAL SUBMISSION INFORMATION

A. Address

All proposals should be sent to the following address:

Office of Space Science and Applications
Code EPM-20, (APL)
National Aeronautics and Space Administration
Washington, DC 20546

The procedures for submission of foreign proposals are contained in Appendix E, Section II, paragraph 3. Proposals from U.S. institutions that include foreign participation must ensure that the foreign participants follow the procedures for foreign proposals.

B. Format and Content

Please specify on the cover of the proposal whether the proposal is for flight or for concept study.

1. Flight Proposals

Proposals for flight investigations should be submitted in two sections: Investigation and Technical Plan (and appendix), and Management and Cost Plan. The cost section can be omitted for foreign proposals. Guidelines and additional information regarding proposal format and proposal preparation are provided in Appendix E. Each proposal must identify one person as Principal Investigator. The position of co-principal investigator is not acceptable on proposals submitted under this AO. Unless specified otherwise, the Principal Investigator will be assumed to be the single point of contact during the proposal evaluation period. Similarly, it is NASA's intention to support

the smallest investigator teams necessary to successfully execute the selected investigations. Proposers are requested, therefore, to briefly describe the specific function of each co-investigator and other senior person listed in the proposal.

Completed technical data sheets will be required with each flight proposal. Blank technical data sheets will be provided with the proposal package distributed at the preproposal conference or sent to persons submitting letters of intent to propose. Proposers should exercise care that no inconsistencies arise between technical data in the proposal and the technical data sheets.

2. Concept Proposals

Proposals for concept studies should also be submitted in two sections: Investigation and Technical Plan (and appendix), and Management and Cost Plan. Guidelines and additional information regarding proposal format and proposal preparation are provided in Appendix E. Each proposal must identify one person as Principal Investigator. Unless specified otherwise, the Principal Investigator will be assumed to be the single point of contact during the proposal evaluation period. Proposals should list the complete study team. It is NASA's intention to support the smallest study teams required to successfully conduct the selected studies. Proposers are requested, therefore, to briefly describe the specific function of each team member.

U.S. investigators who wish to propose studies with non-U.S. partners should indicate the division of responsibility between NASA and the international partner. The proposal should include a statement of the proposed role of the international partners during the concept study, and, if selected, during development and operation, a statement of expected cost sharing between NASA and the foreign partner, an endorsement by the sponsoring foreign space agency, and, in the case of facility studies, a statement that the foreign space agency will continue to support the facility, should it be selected for further definition and development. It should be noted that in case of a conflict between a proposal and a memorandum of understanding regarding international cooperation on the Space Station, the Space Station memorandum will take precedence.

C. Proposal Quantity

Thirty-five (35) copies of the investigation and technical plan and fifteen (15) copies of the management and cost plan must be submitted. All proposals and appended materials must be in English. One copy of each section should be clear black on white paper, of a quality suitable for reproduction. The investigation and technical plan of each proposal (Appendix E, Section 1)

should be limited to the equivalent of 25 single-spaced, typewritten pages. Additional pertinent information, such as recent publications, may be added as an appendix. It is our intention, however, to ease the burden of proposal preparation and review by limiting the volume of information to be submitted and reviewed. In no case should the appendix exceed 25 pages, and NASA makes no commitment to consider material in the appendix in evaluating the proposal.

D. Certification

The proposal must be signed by an institutional official, who is authorized to certify institutional support and sponsorship of the investigation and the management and the cost parts of the proposal. In cases of non-U.S. proposals, including foreign participation in a U.S. led proposal, the foreign sponsoring space agency must certify support and sponsorship of their participation. If a foreign proposal is selected, NASA will arrange with the sponsoring foreign agency for the proposed participation on a cooperative (no exchange of funds) basis, in which NASA and the sponsoring agency will each bear the cost of discharging their respective responsibilities.

E. Letter of Intent

A Letter of Intent to Propose should be sent to the following address to arrive on or before August 19, 1988.

Office of Space Science and Applications
Code EPM-20, (APL)
National Aeronautics and Space Administration
Washington, DC 20546

The Letters of Intent should include the following information:

Name, Address, and Telephone Number of the Principal Investigator and all Co-Investigators. (If available, it would be helpful to include electronic mail addresses and data-fax numbers.)

Name and Address of sponsoring organizations.

Specific objectives of the investigation.

Whether the proposal will be for a flight investigation or for a concept study.

Persons submitting letters of intent will be sent additional information to aid in the preparation of proposals. Material in the letters of intent is for information only and is not binding

on the signers. Foreign proposers and U.S. proposers submitting proposals that contain foreign participants should send an information copy of the letter of intent to the NASA International Relations Division, Code XI, Office of External Relations, National Aeronautics and Space Administration, Washington, DC 20546.

F. Preproposal Conference

A preproposal conference will be held on August 25, 1988, 8:30 a.m. to 4:00 p.m. at the NASA Marshall Space Flight Center, Huntsville, Alabama. The conference will be held in the Morris Auditorium, Building 4200. To ensure that visitor badges will be available upon arrival, prospective attendees are requested to notify Ms. Linda Morgan of your planned attendance at the following address: JA-21, Payload Project Office, National Aeronautics and Space Administration, Marshall Space Flight Center, Alabama 35812, or telephone 205-544-1948, (FTS 824-1948). Ms. Morgan can also be reached on the NASA telemail system at [RMARMANN/NASAMAIL] and by data-fax at 205-544-5422. Notification should be received by Ms. Morgan before August 18, 1988. Attendees are encouraged to submit questions in advance so that replies can be prepared prior to the preproposal conference.

G. Technical Contacts

Inquiries of a technical nature should be directed to Dr. Philip Cressy, Code EM, National Aeronautics and Space Administration, Washington, DC 20546, or telephone number 202-453-3971. Inquires of a programmatic or administrative nature should be addressed to Ms. Paula Burnett Frankel, at the same address and telephone number. Dr. Cressy and Ms. Frankel can also be reached on the NASA telemail system at [PCRESSY/NASAMAIL] and [PBURNETT/NASAMAIL]. Inquiries of scientific nature should be directed to:

ASTROPHYSICS

Dr. George Newton
Code EZ
AO No. OSSA 3-88
National Aeronautics and Space Administration
Washington, DC 20546
Telephone: 202-453-1435

COMMUNICATIONS AND INFORMATION SYSTEMS

Mr. Louis O. Caudill
Code EC
AO No. OSSA 3-88
National Aeronautics and Space Administration
Washington, DC 20546
Telephone: 202-453-2137

LIFE SCIENCES

Ms. Lynn D. Griffiths
Code EB
AO No. OSSA 3-88
National Aeronautics and Space Administration
Washington, DC 20546
Telephone: 202-453-1545

SOLAR SYSTEMS EXPLORATION

Dr. William L. Quaide
Code EL
AO No. OSSA 3-88
National Aeronautics and Space Administration
Washington, DC 20546
Telephone: 202-453-1596

SPACE PHYSICS:

Dr. W. Vernon Jones
Code ES
AO No. OSSA 3-88
National Aeronautics and Space Administration
Washington, DC 20546
Telephone: 202-453-1514

Persons interested in receiving a copy of the EOS Announcement of Opportunity should contact:

Dr. Dixon M. Butler
Code EPM-20
AO No. OSSA-1-88
National Aeronautics and Space Administration
Washington, DC 20546
Telephone: 202-453-1681

IX. PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

A. Evaluation of Proposals

Proposals received in response to this AO will be reviewed and selected in accordance with the procedures stated in NASA Federal Acquisition Regulation Supplement (NFS) 18-70. (NFS 18-70 replaces NASA Handbook 8030.6.) Note specifically that the proposal evaluation will be aided by contractors selected by NASA. A contractor, utilizing scientific peers, will evaluate the scientific and technical strengths and weaknesses of each proposal and will provide the NASA Headquarters Space Station Utilization Branch with a report summarizing these strengths and weaknesses. Proposers should note specifically Appendix D, Sections V, Treatment of Proposal Data, and Section IX, Disclosure of Proposals Outside Government. If any part of the proposal is indicated as not releasable outside the Government for evaluation purposes, the proposal cannot be evaluated under this AO.

A subcommittee of the Space Science and Applications Steering Committee made up of full-time Government employees will be appointed by the Associate Administrator for Space Science and Applications. This subcommittee will, upon consideration of the contractor's report, categorize all proposals in accordance with the category definitions contained in NFS 18-70. Proposals will be further reviewed for engineering, integration, management, and cost aspects by a NASA field center and possibly by the Space Station Program Office. On the basis of these reviews and the reviews of the NASA Headquarters Flight Systems Division and the Steering Committee, the Associate Administrator for Space Science and Applications will select the investigations.

B. Evaluation Criteria

The selection of proposals which best meet the scientific objectives stated in the AO is the fundamental aim of the investigation acquisition process. To achieve this aim, the criteria listed below have been established for the evaluation of all proposals submitted under this AO. All criteria apply equally to flight and concept study proposals except where the word Flight appears in parenthesis following the criterion. The criteria indicated with the word Flight apply to flight proposals only. The criteria are listed in order of decreasing importance:

1. The overall scientific and/or technical merit of the proposed investigation and its likely impact on space science and applications.

2. The relationship of the proposed investigation to other program elements in the subject discipline and the role of the investigation in addressing high priority goals of the discipline.

3. The adequacy of the proposed instrumentation to fulfill the objectives of the investigation.

4. The appropriateness of the Space Station as the observing platform for the proposed investigation.

5. The compatibility of the instrumentation with Space Station hardware, functional interfaces, and operational environment available during the assembly phase. (Flight)

6. For facility proposals, the ease of accessibility to facility data and the usefulness of the proposed facility or facility instrument to the expected facility user community.

7. Current state of development of the proposed instrumentation and its ability to meet the schedule imposed by this AO and the Space Station; and to meet the cost target for the investigation. (Flight)

8. The adequacy and completeness of the data reduction and analysis plan.

9. The capabilities and experience of the investigators.

10. The experience and interest of the investigator's institution in providing the necessary support to ensure that the investigation or concept study can be completed satisfactorily.

11. Other factors that pertain to accomplishing the program's objectives; these factors include management and organizational arrangements.

X. PROPOSAL SCHEDULE

The following are key dates pertaining to this Announcement:

Date of release of AO	July 22, 1988
Letters of Intent due	August 19, 1988
Preproposal Conference	August 25, 1988
Proposals due	November 14, 1988
Latest date to accept foreign government endorsements	December 23, 1988
Target date for announcement of selections	April 30, 1989

XI. APPENDICES

The following appendices are provided as a part of this announcement:

A. Space Station Manned Base Attached Payload Accommodations
B. Astromag Facility Description
C. Cosmic Dust Collection Facility Description
D. General Instructions and Provisions
E. Detailed Guidelines for Proposal Preparation
F. OSSA Official Mailing List Update.

The Attached Payload Program is the first opportunity to use the Space Station for science and applications investigations. I look forward to receiving many sound proposals which will address high priority science and applications goals and lead the way in exploiting the new capabilities to be provided through flight on the Space Station.

L. A. Fisk
Associate Administrator for
Space Science and Applications

Enclosures

APPENDIX A

SPACE STATION MANNED BASE ATTACHED PAYLOAD ACCOMMODATIONS

1. Introduction

At the end of Phase I, the Space Station Program will include a permanently manned research facility in low-Earth orbit, an unmanned Polar Platform, and an associated ground-based infrastructure. The Phase I Manned Base features a 508-foot transverse boom with four centrally located pressurized modules providing habitation and research laboratory space. Located at each end of the boom are photovoltaic arrays generating a minimum of 75 kW of power, which will be shared by the Station and all user payloads. Provision will be made to attach payloads along the transverse boom. In what follows, such payloads will be called attached payloads. Power, heat rejection, structural support, orientation, command and control, and data handling will be provided to the attached payloads at utility ports located in the truss assembly of the transverse boom. The Space Station Phase I Program will provide four utility ports at which Attached Payload Accommodation Equipment (APAE) can be attached.

The APAE provides the accommodations for user payloads external to the pressurized volume of the Space Station Manned Base. The APAE provides the structural support and all hardware and software interfaces required for the installation, check-out, operation, maintenance, repair, and removal of attached payloads covered under this AO. Additional accommodations for attached payloads having minimal resource requirements are also under consideration at this time.

The APAE includes systems capable of accommodating large or moderate sized single instruments and groups of small payloads. The APAE is being designed to provide payload interfaces during activities which include the following:

- Launch to orbit and return to the ground of certain attached payloads;
- Installation and removal of Station-attached payloads;

- o Normal payload operations and, in some cases, payload servicing or repair;
- o Provision to the payloads of required power, thermal control, command and data transmission, and other services;
- o Coarse payload pointing, where required, to compensate for core Station motion and/or to seek specific targets;
- o Attitude determination for attached payloads that require attitude knowledge for pointing relative to Earth, the Sun, stellar, or other targets to an accuracy better than that provided by the core Station guidance, navigation, and control (GN&C) system.

The Space Station development program has recently entered phase C/D with the selection of prime contractors to finalize the design and build the Phase One Space Station. The descriptions below, while correct in general terms, will probably change in detail as the Program progresses.

2. Location for Attached Payloads

The Space Station assembly sequence is scheduled to begin in early 1995. The Station should be capable of sustaining some attached payload operations during the following year (1996). Figure A-1 shows the Space Station baseline configuration at Phase I completion in perspective, top and front views. The direction of flight (DOF) will be as indicated and the nominal attitude is with the long axis of the transverse boom orthogonal to the orbit plane and the long axes of the manned pressurized modules tangent to the orbit. Note that the photovoltaic power array assemblies rotate about the transverse boom axis once per orbit.

There are 15 five-meter truss bays in the transverse boom between the power array assembly attachment joints (alpha-joints). It is planned that attached payloads will be located inboard of the alpha joints at specified locations on both the starboard side and port side of the boom. In addition, it may be feasible to attach small payloads at other locations both inside and outside of the alpha joints. The dimensions on the front view of the Station may be used for initial instrument field of view

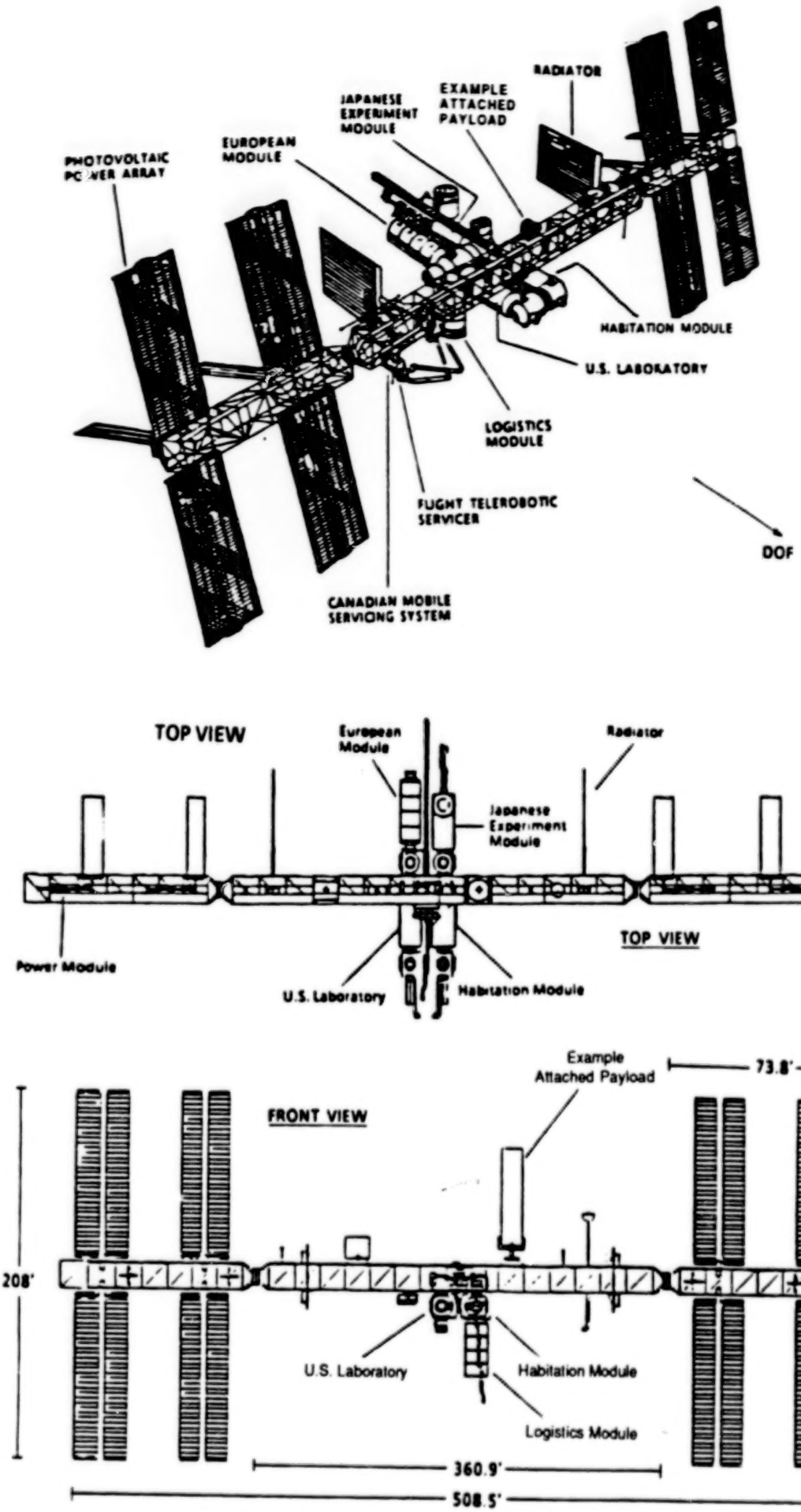

Figure A-1. Space Station Baseline Configuration

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assessments. The attached payloads may be mounted on the top, the bottom, or the back faces of the truss bays and additional truss sections may be added, in 5-meter increments, at right angles to the transverse boom to improve the instrument fields of view.

3. Space Station Assembly Sequence

It is planned that the Manned Base be assembled in orbit over a period of approximately three years. The currently p'anned sequence of assembly is indicated in Table A-1. When fully assembled, the Phase I Station will support a crew of 8. A Man-Tended Capability (MTC) will be achieved much earlier with the addition of the U.S. Laboratory Module, currently planned for Flight 4 (MB-4). The MTC configuration is shown in Figure A-2. Normal support and operations with attached payloads are expected to commence following Flight 8 (MB-6) which will ferry attached payloads and accommodation equipment to the Station. Some capability to accommodate attached payloads may be available earlier. If so, such payloads must be able to operate for extended periods without crew attention. Permanently Manned Capability (PMC) will be achieved with the completion of the outfitting of the US habitation module, currently planned for Flight 11 (MB-9). The Phase One Space Station should be completed with the outfitting of the pressurized logistic module following Flight 20 (OF-2). The probable configuration of the completed Phase One Station is illustrated in Figure A-1. It should be emphasized that any attached payloads shown in Figures A-1 and A-2 are for illustration purposes only.

Station attitude with respect to the local vertical and local horizontal (LVLH) is expected to be $\pm 5^{o}$ with a stability of $\pm 2.5^{o}$. Payloads which require a specific orientation or pointing and do not have support of a Space Station-supplied Payload Pointing System (PPS) should include provision for their own attitude or pointing control.

4. Mechanical, Electrical & Data Interfaces

All planned interfaces between attached payloads and the Space Station will be through Station-supplied APAE. (Additional interfaces for small attached payloads are under study.) The main mechanical interface items of APAE are the Stati[illegible] Interface Adapter (SIA), the

TABLE A-1. SPACE STATION ASSEMBLY SEQUENCE (3/31/88 PLAN)

1.	FEL	MB-1	18.75 PV MODULE, STBD TRUSS, ALPHA JOINT, ERECTOR SET, AVIONICS, TANK FARM WATER ELECTROLYSIS. RCS MODULES (2), UNPRESS. DOCK. ADAPTER, S-BAND ANTENNA	1-JAN-95
2.		MB-2	AFT STBD NODE, STBD TCS W/9 RAD. PANELS, FTS & SHELTER, STINGER/RESISTOJET, TDRSS, ANTENNA, TANK FARM, PRESS. DOCKING ADAPTER, CMGs (6)	1-APR-95
3.		MB-3	AFT PORT NODE, MSC PHASE 1, TANK FARM, STBD RADIATOR PANELS, PRESS. DOCKING ADAPTER, FMAD, STANDARD AIRLOCK	1-JUL-95
4.	EMTC	MB-4	U.S. LAB MODULE	1-SEP-95
5.		P-1	U.S. POLAR PLATFORM	22-OCT-95
6.		MB-5	PORT INBD P.V. MODULE, ALPHA JOINT, PORT TRUSS, RCS MODULES (2), PORT RADIATOR, STBD RADIATOR PANELS, TANK FARM, SSEMU VERIF. UNIT	1-NOV-95
7.		OF-1	PRESS. LOG MOD, MODULE OUTFITTING	1-JAN-96
8.		MB-6	SSRMS-2, HB AIRLOCK, ATTACH P/L & EQUIP.	1-MAR-96
9.		MB-7	U.S. HAB MODULE	1-MAY-96
10.		MB-8	FORWARD NODES, CUPOLAS (2)	1-JUL-96
11.	PMC	MB-9	CREW (4), LOGISTICS MODULES, SSEMUs (4)	1-OCT-96
12.		MB-10	STBD, PORT OUTBOARD PV. MODULES	15-NOV-96
13.		L-1	LOGISTICS MODULES, SPDM	1-JAN-97
14.		MB-11	JEM MODULE, JEM EXPOSED FACILITY #1, CREW (8)	15-FEB-97
15.		L-2	LOGISTICS MODULES, ATTACH P/L & EQUIP.	1-APR-97
16.		MB-12	ESA MODULE	15-MAY-97
17.		L-3	LOGISTICS MODULES, MMD PHASE 1	1-JUL-97
18.		MB-13	JEM EXPOSED FACILITY #2, JEM ELM, JEM LOGISTICS & PAYLOADS	15-AUG-97
19.		L-4	LOGISTICS MODULES	1-OCT-97
20.		OF-2	PRESS. LOG MOD. MODULE OUTFITTING	15-NOV-97

ASSEMBLY COMPLETE

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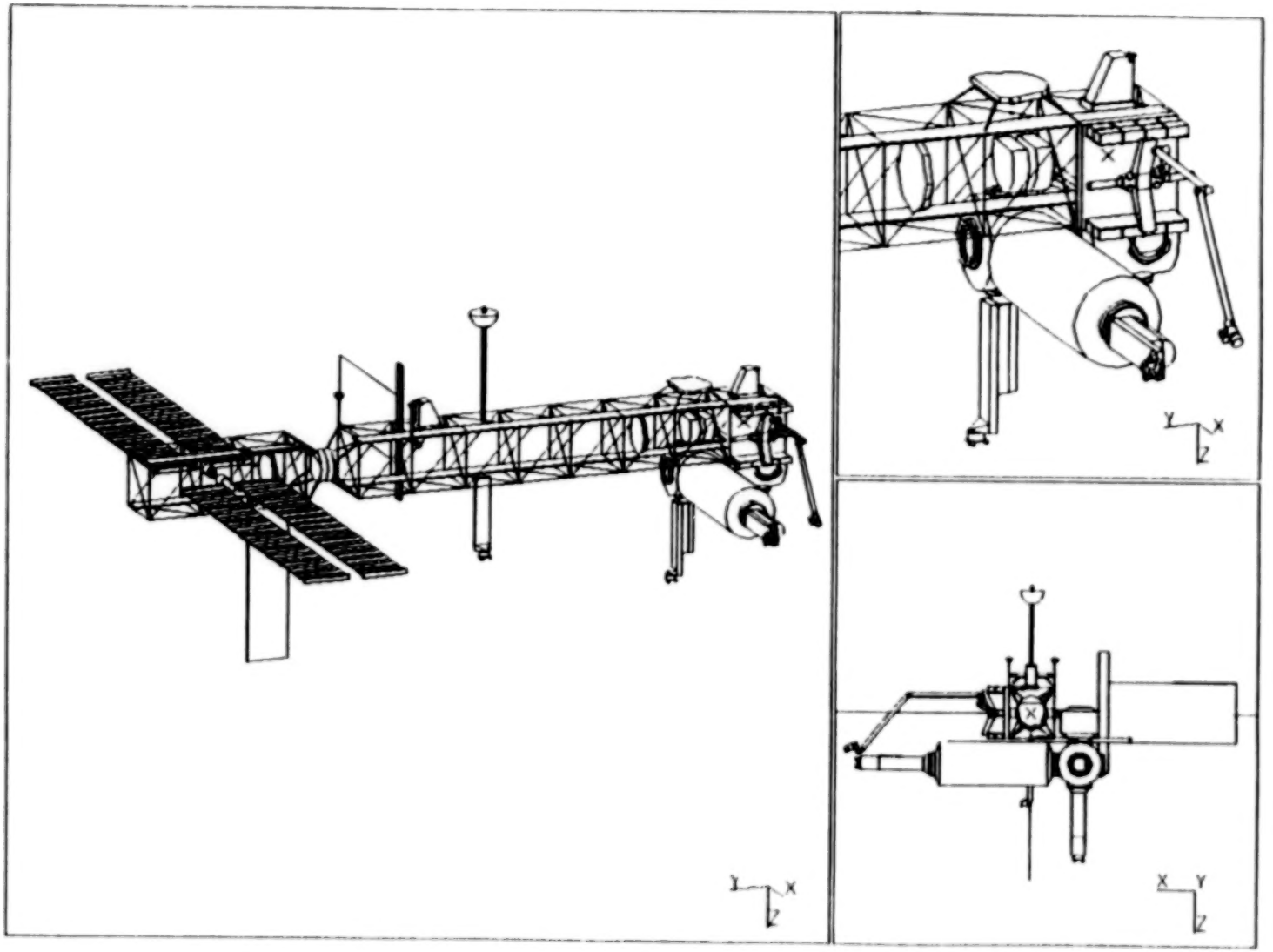

Figure A-2. Early Man-Tended Capability, Flight 4 Configuration

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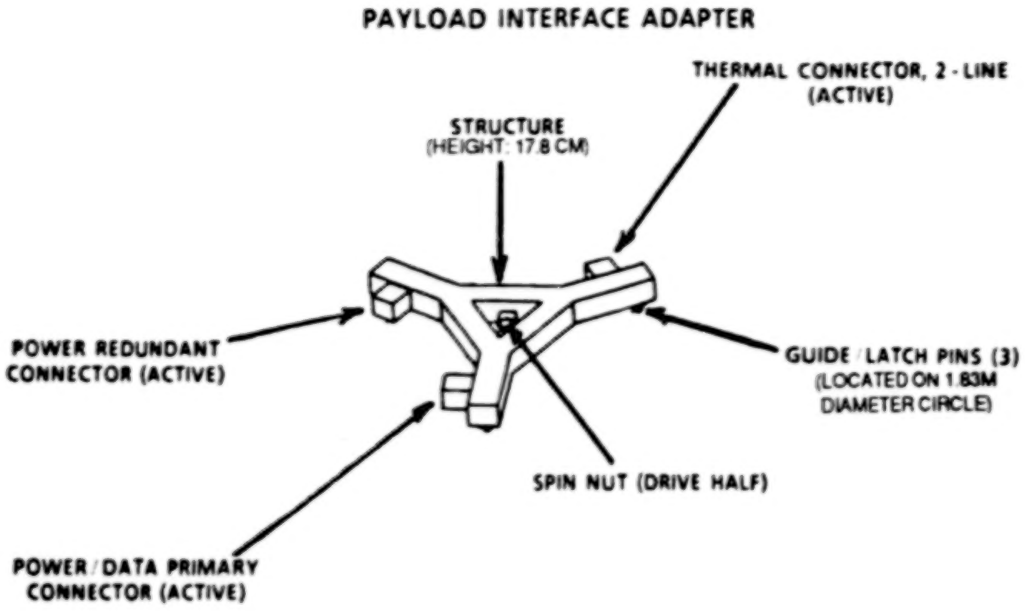
Payload Interface Adapter (PIA), the Deck Carrier Assembly (DCA) and the PPS (if required). The current concepts for the SIA and PIA are illustrated by Figure A-3.

The SIA provides standard mounting and resource interfaces to the Station's truss and utilities needed for attached payloads. An attached payload requires the use of a PIA to interface to the SIA. The triangular-shaped PIA is integrated to the payload assembly on the ground. The SIA is Station mounted equipment which provides the structural interface to the truss nodes and extends the resource interface from the Station's utility ports to the PIA. The SIA/PIA interface includes mechanical latching and connector interfaces for the power, thermal fluid, and command and data resources.

A payload may be mounted directly to a PIA or, alternatively, a payload may be mounted to a Station-supplied Deck Carrier Assembly (DCA) to which the PIA is also attached. The DCA is an optional means of providing structural support for a payload of limited size or for a number of smaller payloads. During transportation to and from the Space Station the DCA spans the Orbiter cargo bay to provide the payload(s) and any other associated APAE with structural support. When more than one payload is to be attached to the DCA, a Multiple Payload Adapter (MPA) must be used as the interface between the payloads and the DCA. The MPA provides multiple locations for the mounting of compatible payloads in a manner that allows EVA/robotic changeout.

Medium size payloads may be mounted on NASA-provided Orbiter pallets prior to transportation to, and attachment at, the Space Station. Large payloads or payloads designated for installation in the PPS will be transported to the Station as a separate Orbiter cargo item and, on occasion, may be assembled on orbit. Figure A-4 illustrates some payload attachment options.

The PPS is a three-axis gimbal, center of mass payload suspension system with configuration and capabilities as shown in Figure A-5. Instruments mounted to the PPS off their center of mass can be utilized


PAYLOAD INTERFACE ADAPTER
THERMAL CONNECTOR, 2 - LINE (ACTIVE)
STRUCTURE (HEIGHT: 17.8 CM)
POWER REDUNDANT CONNECTOR (ACTIVE)
GUIDE / LATCH PINS (3) (LOCATED ON 1.83M DIAMETER CIRCLE)
SPIN NUT (DRIVE HALF)
POWER / DATA PRIMARY CONNECTOR (ACTIVE)

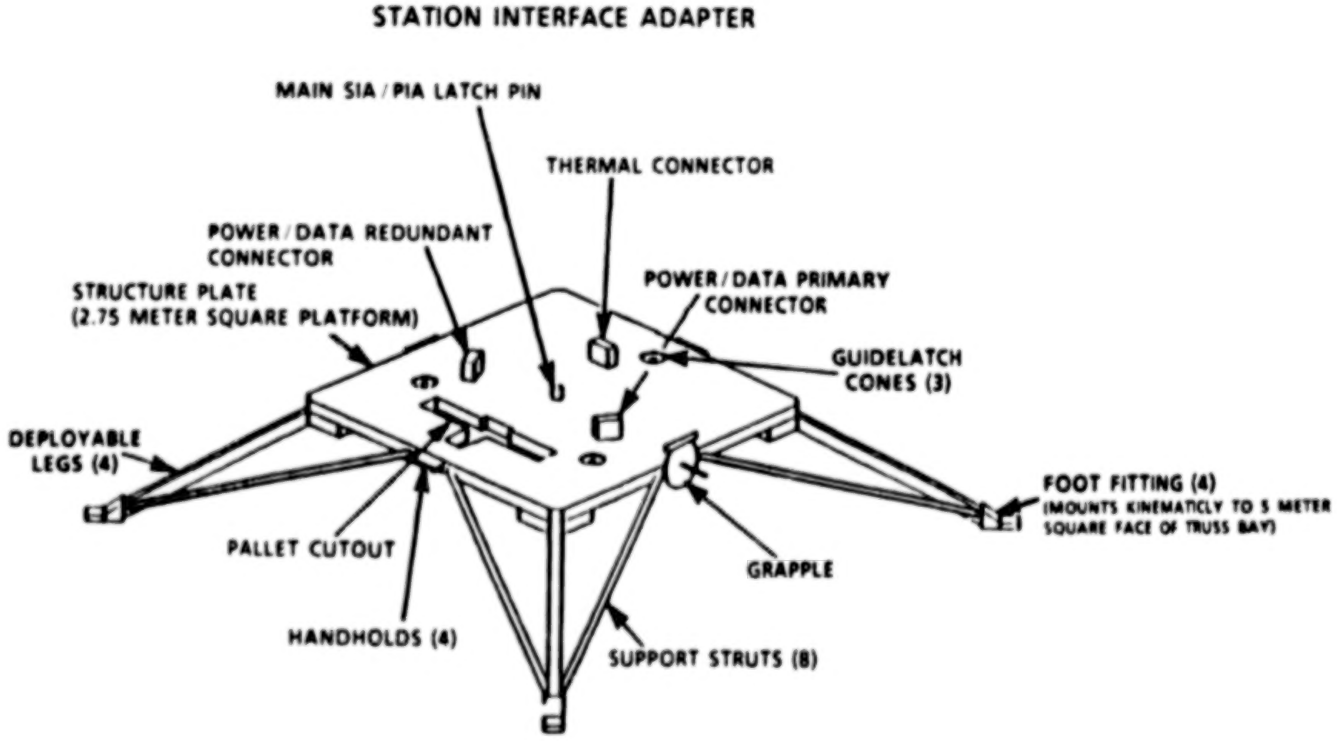

STATION INTERFACE ADAPTER
MAIN SIA / PIA LATCH PIN
THERMAL CONNECTOR
POWER / DATA REDUNDANT CONNECTOR
STRUCTURE PLATE (2.75 METER SQUARE PLATFORM)
POWER / DATA PRIMARY CONNECTOR
GUIDELATCH CONES (3)
DEPLOYABLE LEGS (4)
FOOT FITTING (4) (MOUNTS KINEMATICLY TO 5 METER SQUARE FACE OF TRUSS BAY)
PALLET CUTOUT
GRAPPLE
HANDHOLDS (4)
SUPPORT STRUTS (8)

Figure A-3. Payload Mechanical Attachment Interfaces

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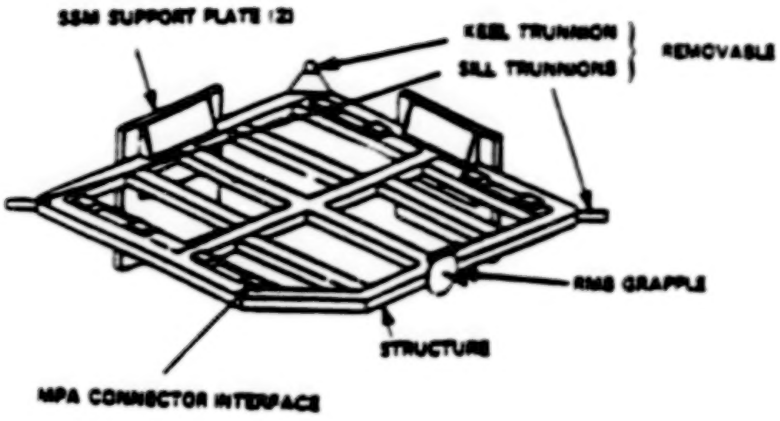
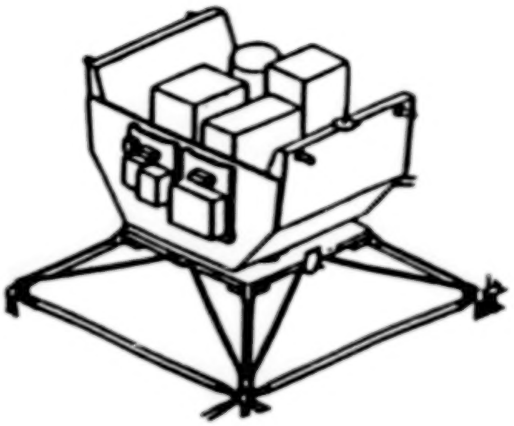
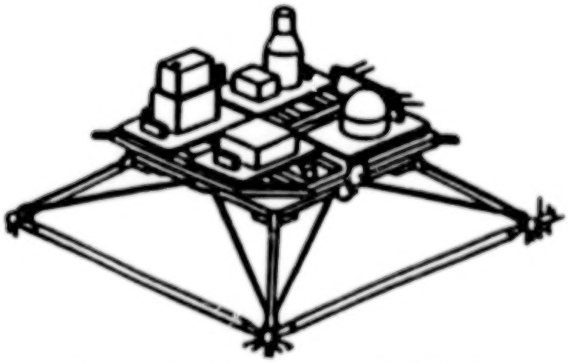


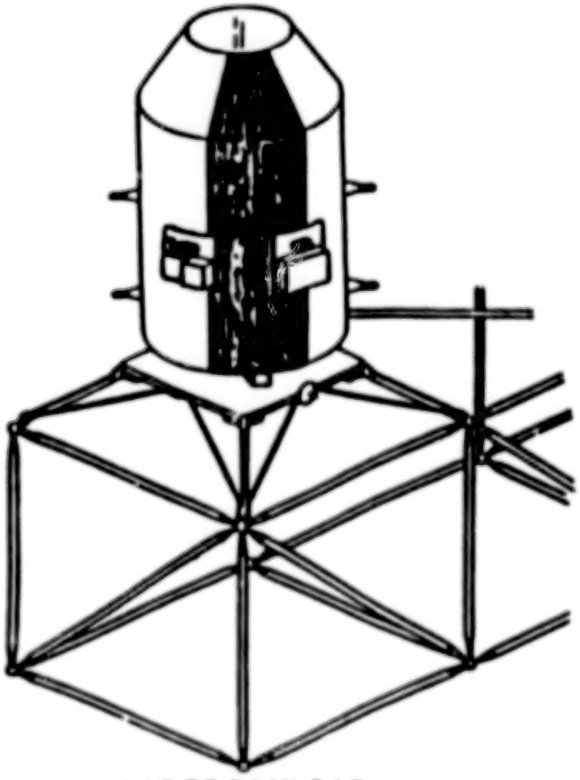
Deck Carrier Assembly



MEDIUM PAYLOAD
ON PALLET



MULTIPLE SMALL PAYLOADS
ON DECK CARRIER



LARGE PAYLOAD
INSTALLED ON-ORBIT

Figure A-4. Payload Attachment Options

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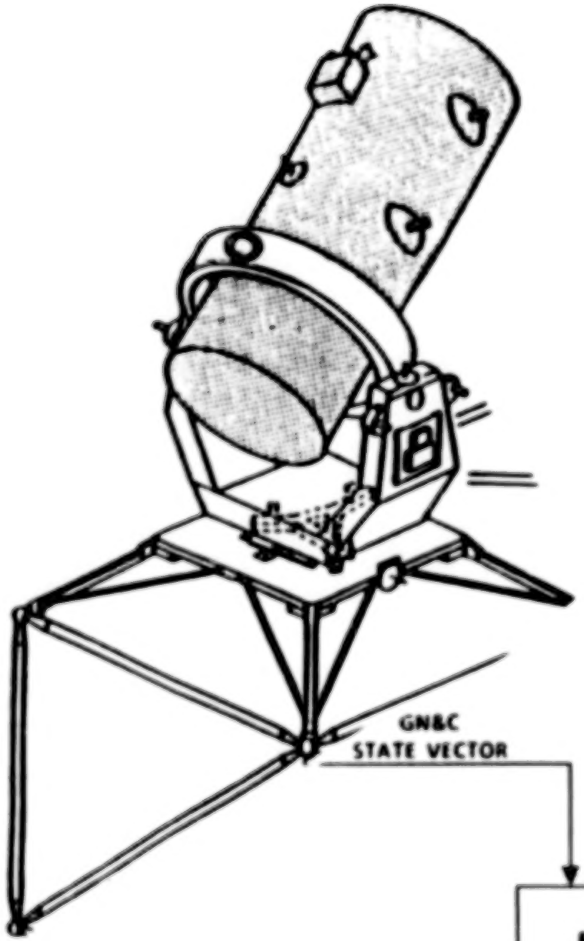
PAYLOAD POINTING SYSTEM



- UP TO 3M DIAMETER PAYLOADS
- CENTER-OF-MASS PAYLOAD SUSPENSION
- CENTER OF ROTATION TO YOKE BASE - 2.5M
- UP TO 6000 KGM PAYLOAD IF ATTACHED ON-ORBIT
- ± 60 ARC-SEC POINTING
- 30 ARC-SEC PEAK-TO-PEAK STABILITY OVER 1/2 HOUR
- < 15 ARC-SEC / SEC JITTER
- IMPROVED PERFORMANCE IF PAYLOAD PROVIDES ERROR SIGNALS

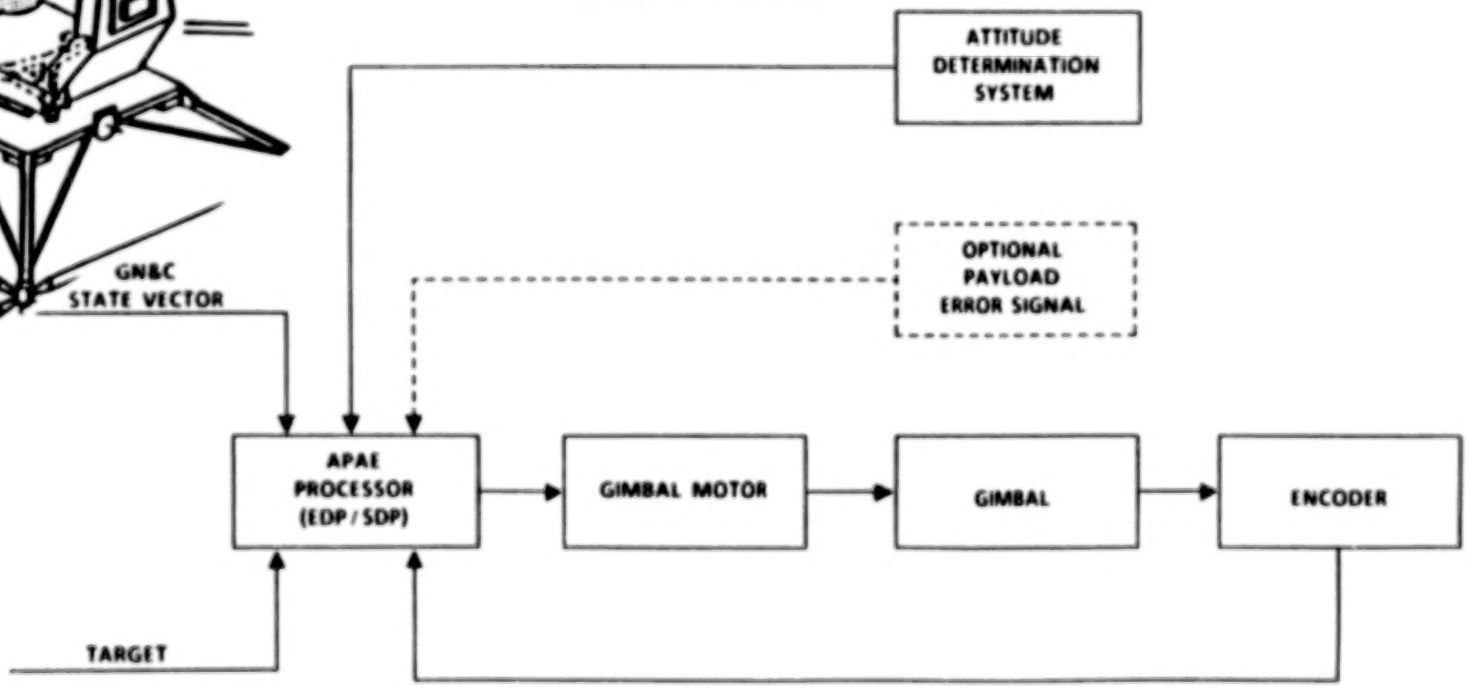


Figure A-5. Payload Pointing System

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with degradation (TBD) of performance. A separate attitude determination system (ADS) is also Station-supplied to be used in conjunction with or separate from the PPS. Pointing error signals for gimbal control may be provided by the instrument to further improve pointing and stability performance.

Other hardware needed to support Space Station Attached Payloads include System Support Modules (SSMs) and Grapple Fixtures.

An SSM provides control and distribution of power, cooling fluid, data, and communications to the payload. The SSM may be mounted at any one of a number of locations on the APAE/payload structure including the payload (or payload-provided carrier), the deck carrier, or the Payload Pointing System. The particular mounting location is determined by the configuration of the APAE/payload structure.

Grapple fixtures provide mechanical and electrical interfaces between APAE and/or payload and the Orbiter and/or Space Station Remote Manipulator Systems (RMSs) during handling activities. The location of grapple fixtures is dependent on the configuration of the APAE and payload because of access and structural lift point considerations.

At each SIA location 12 Kw of electrical power and 12 Kw of active (fluid) thermal control will be available. An APAE (without a PPS) is expected to dissipate 2 Kw of this capability leaving 10 Kw for its attached payloads. With a PPS, an APAE will dissipate 7 Kw leaving 5 Kw for the payloads. The Station electrical power bus is 208 V. 20 KHz AC. This power is provided to an attached payload and also within the associated APAE through a station-supplied Payload Interface Unit (PIU). Space Station-provided power converters may, however, also be available to the user at 28V DC, and 60 Hz 120/208 V.

For payload commanding and telemetry, the Space Station provides uplink command rate capability up to 100 kbps, and downlink telemetry/data rate services up to 10 Mbps (standard service) and up to 100 Mbps (optional service) per utility port. Payloads using the 10 Mbps service will be

interconnected with the Space Station data bus; high data rate services will be routed directly to the Space Station communications system over separate transmission lines. The Space Station will also supply accurate time/frequency signals and an analog video bus.

A "transaction" mode of operation will be imposed, and all transactions will be packetized. The user will be responsible for address and other "header" information required for data/command routing between the payload and the user's workstation (located either on the Space Station or on the ground). The user is also responsible for "end of message" symbols, any desired error detection/correction coding, and local command/data buffering. The maximum allowable block length for each available data rate service is currently TBD; the PI should state preferences in the AO response.

Should users employ a local area network (LAN) on the payload side of the APAE interface, any format/protocol may be used. However, if the user plans to utilize Space Station data management services (see section 5, next page), standard formats/protocols will be imposed and the user will be required either to adopt these or to provide translation. The Space Station software language is Ada.

5. Data Management System (DMS) User Services and Software

The Station will provide DMS user services to perform the functions of:

- Network communications
- Data acquisition and distribution
- On board data storage and retrieval
- Integration, test and verification
- Fault tolerance and redundancy management
- Crew workstation
- User interface and user interface language
- Privacy and data security

The DMS software to support these functions will consist of:

- o Operating system
- o Network operating system
- o User interface management system
- o File, database and archive management
- o Simulation and training
- o Status monitoring
- o Command management and sequencing
- o Fault management and overload control
- o Global caution and warning
- o General support software environment

6. User software responsibilities

The user will be responsible for developing the software that is unique to the operation and control of the attached payload instrument and to the formatting, processing, and reduction of experimental data. The user will be required to:

- o Develop a command list and compatible packet format
- o Identify hazardous operations
- o Develop a telemetry list of compatible packet format
- o Identify any need for external caution and warning
- o Develop the data packet format with provision for recombining multiple packets into a contiguous data stream at a user facility
- o Develop applications software for ground data processing and data reduction
- o Develop application software for on board data processing and data compression as applicable.
- o Identify need for Station crew support and provide necessary software or software linkages for operations and training as applicable.
- o Validate software through Space Station software support environment (SSE)

7. Payload/APAE Interface Verification

The Space Station Program will provide Integration, Test and Verification Facilities (ITVF) to validate both hardware and software interfaces prior to loading equipment into the orbiter cargo bay. Figure A-6 outlines the proposed verification flow including on-orbit verification prior to the start of experiment operations.

8. Transportation and Operational Environments

For preliminary planning, the user may consider the transportation (including STS launch) environments as not significantly different from those previously imposed on Shuttle attached payloads. The contamination environment (particulates, deposition, line-of-sight obscuration, EMI, etc) at the Station during quiescent and non-quiescent periods is, however, currently TBD and subject to further study. The Space Station orbit will be at an inclination of 28.5 degrees at an altitude range of 180 to 250 nautical miles. The station will be periodically reboosted to the higher altitude at approximately 90 day intervals. Over the stated altitude range, the orbital period will range from 91.2 to 93.8 minutes.

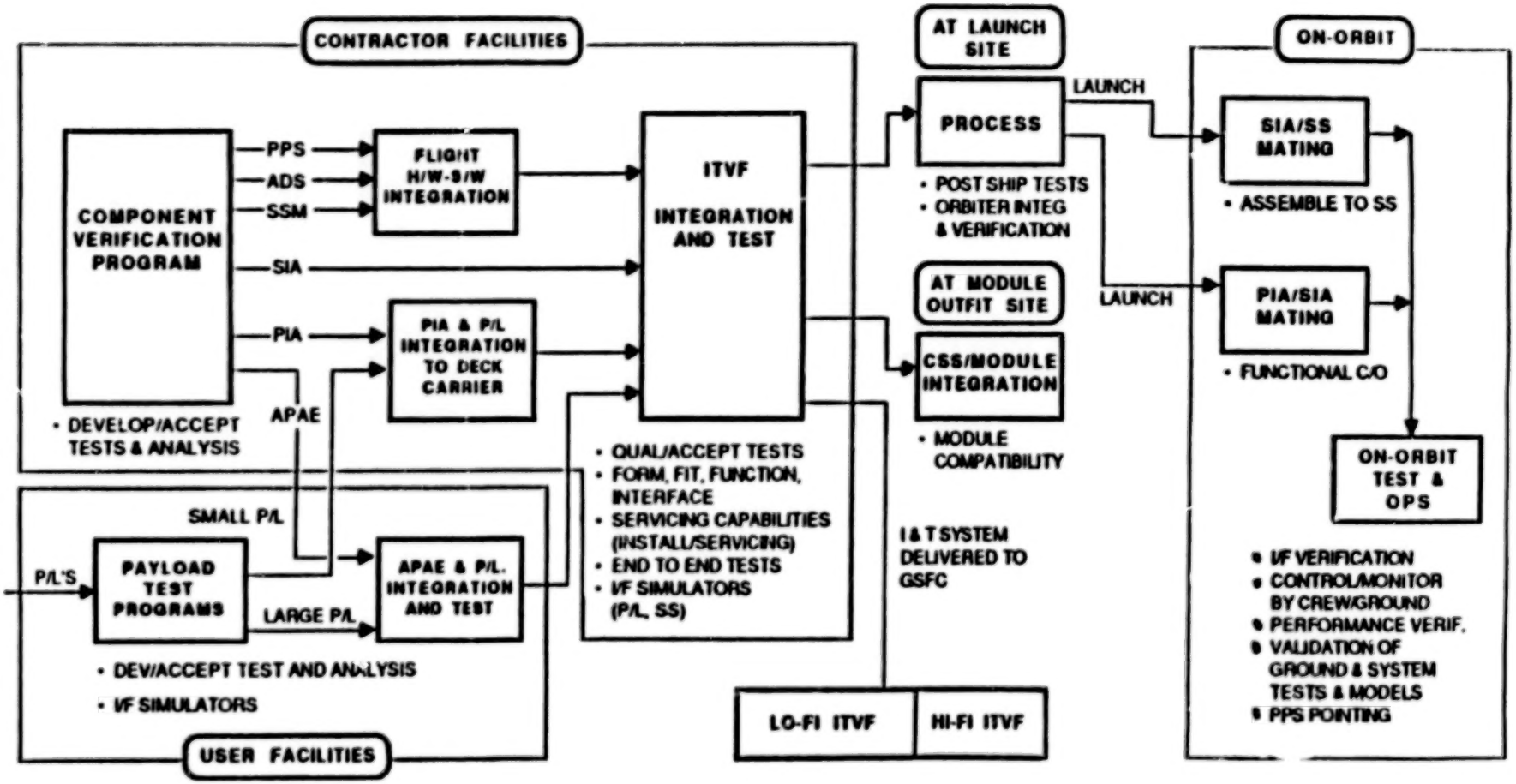

Figure A-6. APAE/Payload Verification Process

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APPENDIX B

ASTROMAG FACILITY

Astromag is a proposed superconducting magnet facility for the Space Station. It is anticipated that the primary use of the Facility will be to measure the properties of cosmic ray particles and to search for antimatter and exotic particles using magnetic spectrometers. There may well be additional applications such as plasma experiments which make use of the generated magnetic field.

The magnet, cryostat, and the data, power, and command interfaces constitute the core facility. The estimated mass of the core facility is 3000 kg. The nominal time between servicing is two years based on the approximate cryostat lifetime.

The proposed configuration for Astromag is two parallel solenoidal coils operated at 2.5×10^6 ampere-turns each but in position to produce zero magnetic dipole moment. The coils have an outside diameter of 1.3 m and an inside diameter of 1.2 m and are 0.23 m wide. There is a 1.7 m separation between the coils. Experiments are not expected to extend beyond the plane of a coil face. See Figures B-1 and B-2.

The Facility will be fixed mounted to the Space Station, probably on a structural "outrigger" to isolate the high-field regions from the Space Station proper. The Space Station will orient a payload toward the local zenith, however, very large offset angles are possible during the Space Station construction phase. Fields of view up to 45° can be accommodated with minimal Earth occultation. Aspect information will be available to $1/4^\circ$ precision.

The recommended data rate for an experiment is less than approximately 100 kbits/second. The recommended command rate for an experiment is less than approximately 10 kbits/second. Experimenters may assume an operational duty cycle of more than 80 percent and data buffering for periods of TDRSS outage will be provided.

It is not anticipated that there will be a connection to the Space Station cooling loop. The thermal control is yet to be defined and will be a joint effort for the core facility and experiments. The proposals should, therefore, include costs for experiment thermal engineering.

The Astromag Facility will be transported to the Space Station by the Space Shuttle, and has been designed to mount to Shuttle attach points. It may be an advantage for the instrument to be able to fit into the Shuttle bay attached to the Astromag core so

that they can be launched together. For planning purposes, it is now assumed that the Astromag core and instruments, when attached to the Space Station, will fit within a 5 m cube. One can assume, for planning purposes, that the total mass for Astromag experiments will be less than 5000 kg.

For further information or a copy of the reports listed below, contact:

Dr. Jonathan F. Ormes
Astromag Facility Scientist
Code 660
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, Maryland 20771
Telephone: 301-286-5705.

Working Group Reports:

Ormes, J. F., et al., ed., The Particle Astrophysics Magnet Facility, Astromag, August 1986, 90 p.

Ormes, J.F., Searching for Anti-Matter from the Space Station, presented at the First International Conference on the Scientific Uses of the Space Station, Venice, Italy, October 1987.

Mewaldt, R. A. and J. F. Ormes, Galactic Cosmic Ray Isotope Spectroscopy from the Space Station, presented at the First International Conference on the Scientific Uses of the Space Station, Venice, Italy, October 1987.

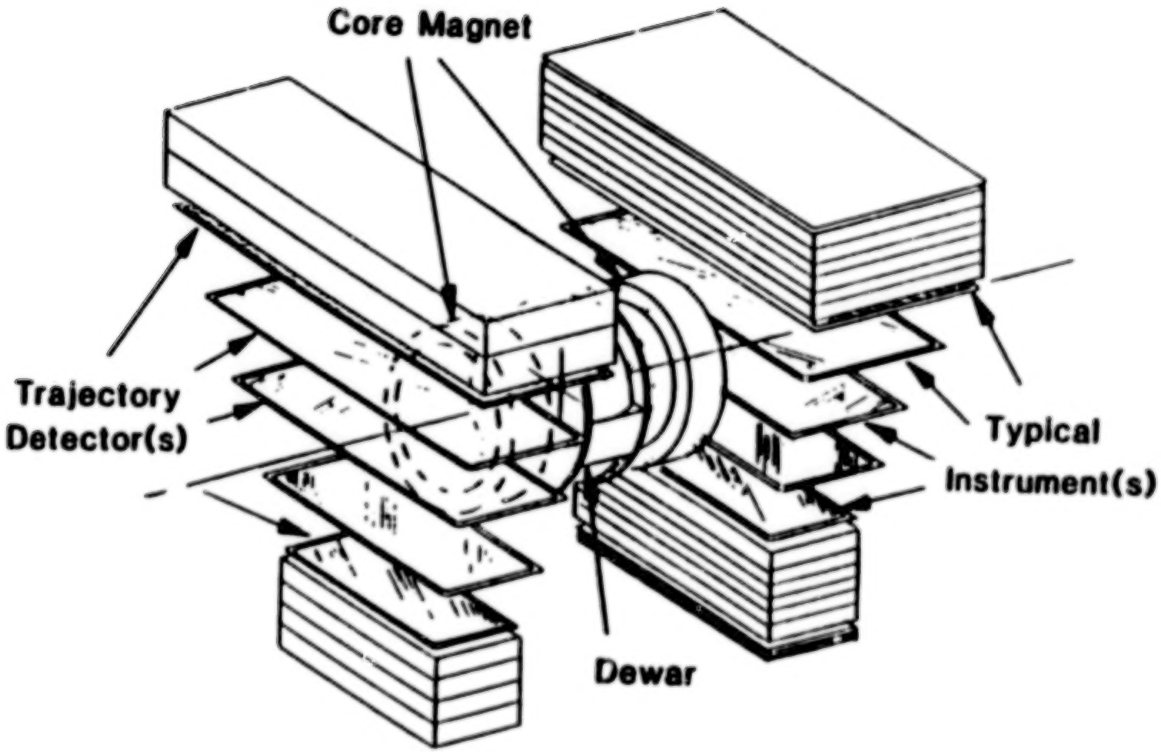

FIGURE B-1, ASTROMAG: TYPICAL FACILITY CONFIGURATION

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ASTROMAG MAGNET CONFIGURATION

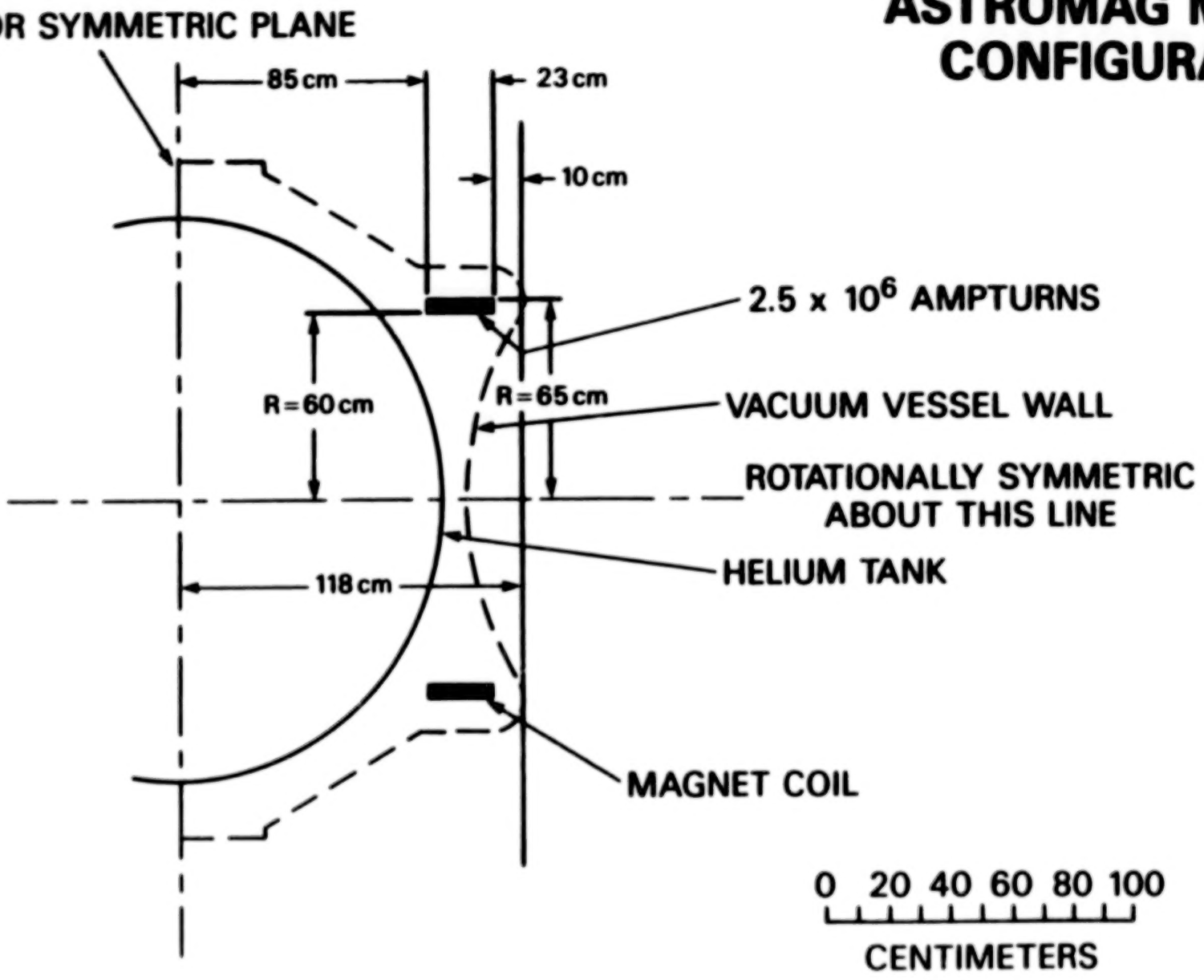

FIGURE B-2

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APPENDIX C

COSMIC DUST COLLECTION FACILITY

The Cosmic Dust Collection Facility (CDCF) is a proposed facility for the Space Station. The purpose of the CDCF is to determine the orbital elements of individual cosmic dust particles, to trap each particle in the least degraded manner, and to provide for the return of the collected particles to Earth, together with the orbital information for their detailed analysis.

Current plans are to deploy some 10 m^2 of detector surface area during one of the earliest Space Station assembly flights. The facility structural architecture will allow for a variety of viewing directions relative to the Space Station velocity vector. A central data system will record all trajectory sensor signals and will interface with the Space Station navigational and telemetry systems. Structural and electronic facility designs will provide standardized, modular interfaces for trajectory sensors and collector media. Methods, procedures, and logistics to harvest the collectors and to return them periodically to Earth will be part of the facility development. Suitable ground operations and procedures for the allocation of materials to the analytical laboratories of Principal Investigators will be established. Approximately 60% of the entire facility will be occupied by facility-provided instruments that will serve the general user community representing, but not limited to, the areas of Planetary Sciences and Exobiology. PI-provided instruments will occupy the remaining surfaces and will allow for specialized studies that are complementary to those of the general user communities. Long-term, observatory-type operations of the CDCF are envisioned and features to accommodate future growth will be incorporated into the initial facility design.

Scientists interested in making use of the facility may participate either in the analysis of the returned materials, or by providing flight instruments, including both trajectory sensors and collectors. Proposals solely for the analysis of data and materials collected by the facility will be solicited at a later date and are, therefore, not included in this AO. Those who desire to provide and utilize fight instruments must respond to this announcement and should be aware of the general constraints which are imposed by the contemplated general facility design and resources allocated to it

Total power: 350 W
Total mass: 350 kg
Total Surface Area: 10 m^2
Deployed Volume: 10 m^3

These resources provide limits for total instrument depth (100 cm) and may be used to estimate power and mass allocation for fractional surface areas required by proposed instruments. The need for modular instrument arrays necessitates the use of standardized mechanical and electrical interfaces; typical module surface dimensions of some 20 X 20 cm may be assumed. This will permit efficient high-grading of the cumulative surface area during harvesting. Trajectory sensors and capture devices should have lifetimes measured in years, as designs that have mechanically and electrically independent trajectory sensors and collector devices are strongly encouraged, such that the trajectory sensors may remain on board the facility for a long time, while the collector devices may be harvested/replaced on relatively short periods.

Investigators who wish to propose instruments for the CDCF must also define and justify the analytical procedures that will be employed in the study of the samples which are collected by the provided instruments.

For further information or copies of the reports listed below, contact:

Dr. Friedrich Horz
Cosmic Dust Collection Facility Project Scientist
Code SN
Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058
Telephone (713) 483-5042

Workshop Reports:

R.M. WALKER, ed., LDEF II Cosmic Dust Experiments, Washington University Internal Report, 1983, 32 pages.

F. HORZ, ed., Trajectory Determinations and Collection of Micrometeorites on the Space Station, LPI Technical Report No. 86-05, 1986, 102 pages.

I.D.R. MacKinnon and W.C. Carey, eds., LPI Technical Report No.88-01, 1988, 81 pages.

APPENDIX D: GENERAL INSTRUCTIONS AND PROVISIONS

I. Instrumentation and/or Ground Equipment

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of Government instrumentation or property that subsequently becomes available, with or without modification, that will meet the investigative objectives.

II. Tentative Selections, Phased Development, Partial Selections, and Participation with Others

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment, and to discontinue the investigative effort at the completion of any phase. The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its team leader or contact point.

III. Selection Without Discussion

The Government reserves the right to reject any or all proposals received in response to this Announcement when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion (other than discussions conducted for the purpose of minor clarification). It is therefore emphasized that all proposals should be submitted initially on the most favorable terms that the offeror can submit.

IV. Foreign Proposals

See Appendix C, Section II A, paragraph 3.

V. Treatment of Proposal Data

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

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RESTRICTION ON USE AND DISCLOSURE OF PROPOSAL AND QUOTATION INFORMATION (DATA)

The information (data) contained in [insert page numbers or other identification] of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

VI. Status of Cost Proposals (U.S. Proposals Only)

The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that following selection and during negotiations leading to a definitive contract, the institution will be required to resubmit or execute a Standard Form (SF) Form 1411 "Contract Pricing Proposal Cover Sheet" and all certifications and representations required by law and regulation.

VII. Late Proposals

The Government reserves the right to consider proposals or modifications thereof received after the date indicated for such purpose, should such action be in the interest of the Government.

VIII. of Space Transportation System Investigations

Investigators are advised that candidate investigations for Space Transportation System (STS) missions can come from many sources. These sources include those selected through the Announcement of Opportunity, those generated by NASA in-house research and development, and those derived from contracts and other agreements between NASA and external entities.

IX. Disclosure of Proposals Outside Government

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desire to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

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X. Equal Opportunity (U.S. Proposals Only)

By submitting a proposal, the investigator and institution agree to accept the the following clause in any resulting contract:

EQUAL OPPORTUNITY

During the performance of this contract, the Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

2. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (a) employment, (b) upgrading, (c) demotion, (d) transfer, (e) recruitment or recruitment advertising, (f) layoff or termination, (g) rates of pay or other forms of compensation, and (h) selection for training, including apprenticeship.

3. The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

4. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

5. The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding the notice to be provided by the Contracting Officer, advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

6. The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

7. The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months preceding the date of award.

8. The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.

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9. If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, the contract may be cancelled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

10. The Contractor shall include the terms and conditions of subparagraph 1 through 9 of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

11. The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as means of enforcing these terms and conditions, including sanctions for non-compliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

XI. Patent Rights

1. For any contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at NFS 18-52.227-70, "New Technology," shall apply. Such contractors may, in advance of contract, request waiver of rights as set forth in the provision at NFS 18-52.227-71, "Requests for Waiver of Rights to Inventions."

2. For any contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, "Patent Rights--Retention by the Contractor (Short Form)" (as modified by NFS 18-52.227-11), and the clause at NFS 18-52.227-73, "Patent Rights Clause for Subcontracts," shall apply.

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APPENDIX E: GUIDELINES FOR PROPOSAL PREPARATION

The following guidelines apply to the preparation of proposals by potential investigators in response to an Announcement of Opportunity. The material presented is merely a guide for the prospective proposer and not intended to be all encompassing or directly applicable to the various types of proposals which can be submitted. The proposer should, however, provide information relative to those items applicable or as otherwise required by the Announcement of Opportunity.

I. Cover Letter

A letter or cover page should be forwarded with the proposal. It should be signed by the investigator and an official by title of the investigator's organization who is authorized to commit the organization that is responsible for the proposal and its contents.

II. Table of Contents

The proposal should contain a table of contents.

III. Identifying Information

The proposal should contain a short descriptive title for the investigation, the names of all investigators, the name of the organization or institution and the full name, address, and telephone number of the Principal Investigator.

SECTION I

INVESTIGATION AND TECHNICAL PLAN

1. INVESTIGATION AND TECHNICAL PLAN

The investigation and technical plan generally will contain the following:

a. **Summary.** A simple, concise statement about the investigation, its conduct, and the anticipated results.

b. **Objective and Significant Aspects.** A brief definition of the objectives, their value, and their relationships to past, current, and future effort. The history and basis for the proposal and a demonstration of the need for such an investigation. A statement of present development in the discipline field.

c. **Investigation Approach**

(1) Fully describe the concept of the investigation.

(2) Detail the method and procedures for carrying out the investigation.

2. INSTRUMENTATION

This section should describe all information necessary to plan for experiment development, integration, ground operations, and flight operations. This section must be complete in itself without need to request additional data. Failure to furnish complete data may

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preclude evaluation of the proposal.

a. **Instrument Description**--This section should fully describe the instrumentation and indicate items which are proposed to be developed as well as any existing instrumentation. Performance characteristics should be related to the experiment objectives as stated in the proposal.

b. **Instrument Integration**--This section should describe all parameters of the instrument pertinent to the accommodation of the instrument in the spacecraft, Spacelab, Shuttle Orbiter, Space Station, etc. These include, but are not limited to volumetric envelope; weight; power requirements; thermal requirements; telemetry requirement; sensitivity to or generation of contamination (e.g., EMI gaseous effluents); data processing requirements.

c. **Ground Operations**--This section should identify requirements for pre-launch or post-launch ground operations support.

d. **Flight Operations**--This section should identify any requirements for flight operations support including mission planning. Operational constraints, viewing requirements, and pointing requirements should also be identified. Details of communications needs, tracking needs, and special techniques, such as extravehicular activity or restrictions in the use of control thrusters at stated times should be delineated. Special communications facilities that are needed must be described. Any special orbital requirements, such as time of month, of day, phase of moon, and lighting conditions are to be given in detail. Describe real-time ground support requirements and indicate any special equipment or skills required of ground personnel.

3. DATA REDUCTION AND ANALYSIS

A discussion of the data reduction and analysis plan including the method and format. A section of the plan should include a schedule for the submission of reduced data to the receiving point. In the case of Space Science programs, the National Space Science Data Center, Greenbelt, MD, will be the repository for such data and the Department of Interior, Sioux Falls, SD, for earth observations data.

4. ORBITER CREW AND/OR PAYLOAD SPECIALIST TRAINING REQUIREMENT

A description of the tasks required of each crew member (Commander, Pilot, Mission Specialist) or payload specialist should be provided, including the task duration and equipment involved. Indicate special training necessary to provide the crew members or payload specialist(s) with the capability for performing the aforementioned tasks.

SECTION II

MANAGEMENT PLAN AND COST PLAN

A. MANAGEMENT PLAN

The management plan should summarize the management approach and the facilities and equipment required. Additional guidelines applicable to non-U.S. proposers are contained herein:

1. MANAGEMENT

a. The management plan sets forth the investigator's approach for managing the work, the recognition of essential management functions, and the overall integration of these functions.

b. The management plan gives insight into the organization proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with the NASA major subcontractors and associated investigators. Likewise, the management plan usually reflects various schedules necessary for the logical and timely pursuit of the work accompanied by a description of the investigator's work plan and the responsibilities of the co-investigators.

c. The plan should describe the proposed method of instrument acquisition. Specifically, it should include the following, as applicable.

(1) Rationale for the investigator to obtain the instrument through or by the investigator's institution.

(2) Method and basis for the selection of the proposed instrument fabricator.

(3) Unique or proprietary capabilities of the instrument fabricator that are not available from any other source.

(4) Contributions or characteristics of the proposed fabricator's instrument that make it an inseparable part of the investigation.

(5) Availability of supporting personnel in the institution to successfully administer the instrument contract and technically monitor the fabrication.

(6) Status of development of the instrument. What additional development is needed. Areas that need further design or in which unknowns are present.

(7) Method by which the investigator proposes to:

(a) Prepare instrument specifications.

(b) Review development progress.

(c) Review design and fabrication changes.

(d) Participate in testing program.

(e) Participate in final checkout and calibration.

(f) Provide for integration of instrument.

(g) Support the flight operations.

(h) Coordinate with co-investigators, other related investigations, and the payload integrator.

(i) Assure safety, reliability, and quality.

(j) Provide required support for Payload Specialist(s), if applicable.

(8) Planned participation by small and/or minority business in any subcontracting for instrument fabrication or investigative support functions.

2. FACILITIES AND EQUIPMENT

All major facilities, laboratory equipment, and ground-support equipment (GSE) (including those of the investigator's proposed contractors and those of NASA and other U.S. Government agencies) essential to the experiment in terms of its system and subsystems are to be indicated, distinguishing insofar as possible between those

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already in existence and those that will be developed in order to execute the investigation. The outline of new facilities and equipment should also indicate the lead time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

3. ADDITIONAL GUIDELINES APPLICABLE TO NON-U.S. PROPOSERS ONLY

The following guidelines are established for foreign responses to NASA's Announcement of Opportunity. Unless otherwise indicated in a specific announcement, these guidelines indicate the appropriate measures to be taken by foreign proposers, prospective foreign sponsoring agencies, and NASA leading to the selection of a proposal and execution of appropriate arrangements. They include the following:

a. Where a "Notice of Intent" to propose is requested, prospective foreign proposers should write directly to the NASA official designated in the Announcement of Opportunity and send a copy of this letter to the International Affairs Division, Office of External Relations, NASA, Washington, DC 20546, U.S.A.

b. Unless otherwise indicated in the Announcement of Opportunity, proposals will be submitted in accordance with this Appendix excluding cost plans. Proposals should be typewritten and written in English.

c. Persons planning to submit a proposal should arrange with an appropriate foreign governmental agency for a review and endorsement of the proposed activity. Such endorsement by a foreign organization indicates:

(1) The proposal merits careful consideration by NASA.

(2) If the proposal is selected, sufficient funds will be available to undertake the activity envisioned.

d. Proposals along with the requested number of copies and letters of endorsement from the foreign governmental agency must be forwarded to NASA in time to arrive before the deadline established for each Announcement of Opportunity. These documents should be sent to:

National Aeronautics and Space Administration
International Affairs Division
Office of External Relations
Washington, DC 20546
U.S.A.

e. All proposals must be received before the established closing date; those received after the closing date will be treated in accordance with NASA's provisions for late proposals. Sponsoring foreign government agencies may, in exceptional situations, forward a proposal directly to the above address if review and endorsement is not possible before the announced closing date. In such cases, NASA should be advised when a decision on endorsement can be expected.

f. Shortly after the deadline for each Announcement of Opportunity, NASA's Office of External Relations will advise the appropriate sponsoring agency which proposals have been received and when the selection process should be completed. A copy of this acknowledgement will be provided to each proposer.

g. Successful and unsuccessful proposers will be contacted

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directly by the NASA Program Office coordinating the Announcement of Opportunity. Copies of these letters will be sent to the sponsoring Government agency.

h. NASA's Office of External Relations will then begin making the necessary arrangements to provide for the selectee's participation in the appropriate NASA program. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(1) A letter of notification by NASA.

(2) An exchange of letters between NASA and the sponsoring foreign governmental agency.

(3) An agreement or Memorandum of Understanding between NASA and the sponsoring foreign governmental agency.

B. COST PLAN
(U.S. Investigations Only)

The cost plan should summarize the total investigation cost by major categories of cost as well as by function.

1. The categories of cost should include the following:

a. **Direct Labor**--List by labor category, with labor hours and rates for each. Provide actual salaries of all personnel and the percentage of time each individual will devote to the effort.

b. **Overhead**--Include indirect costs, which because of its incurrence for common or joint objectives, is not readily subject to treatment as a direct cost. Usually this is in the form of a percentage of the direct labor costs.

c. **Materials**--This should give the total cost of the bill of materials including estimated cost of each major item. Include lead time of critical items.

d. **Subcontracts**--List those over $25,000, specify the vendor and the basis for estimated costs. Include any baseline or supporting studies.

e. **Special Equipment**--Include a list of special equipment with lead and/or development time.

f. **Travel**--List estimated number of trips, destinations, duration, purpose, number of travelers, and anticipated dates.

g. **Other Costs**--Costs not covered elsewhere.

h. **General and Administrative Expense**--This includes the expenses of the institution's general and executive offices and other miscellaneous expenses related to the overall business.

i. **Fee** (if applicable).

2. Separate schedules, in the above format, should be attached to show total cost allocable to the following:

a. Principal Investigator and other Investigators' costs.

b. Instrument costs.

c. Integration costs.

d. Data reduction and analysis including the amount and cost of computer time.

3. If the effort is sufficiently known and defined, a funding obligation plan should provide the proposed funding requirements of the investigations by quarter and/or annum keyed to the work schedule.

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NASA MAILING LIST UPDATE

The NASA Office of Space Science and Applications is in the process of Updating and Enhancing their scientific investigation mailing list. Please fill out all the following information, refold the questionaire, tape it, and mail it back to the preprinted address on the reverse side. Thank you for your time.

Please check (all that apply) the type of NASA Mailings you would like to receive.

- ☐ 1. Announcements of Opportunity
- ☐ 2. Space Science and Applications Notices
- ☐ 3. NASA Research Announcements (NRA)
- ☐ 4. Please remove my name from NASA Mailing List

Contact Information: Salutation (Mr., Mrs., Ms., Dr., Prof., etc.): _____

Suffix (Ret., III, Phd., Jr., etc.) _____ Phone: _____

ADDRESS LABEL CHANGE: If the label on reverse side is incorrect, please provide COMPLETE address information.
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First Name, M.I.: _____ Last Name: _____

Organization: _____

Address line 1: _____

Address line 2: _____

Address line 3: _____ Zip _____

Institution type (check all that apply)

- ☐ 1. College or University
- ☐ 2. International
- ☐ 3. Minority Business
- ☐ 4. NASA Center
- ☐ 5. Non-Profit Corporation
- ☐ 6. Other Government Agency
- ☐ 7. Private Industry
- ☐ 8. Small Business

Program Involvement (check all that apply)

- ☐ 1. Principal Investigator
- ☐ 2. Co-Investigator
- ☐ 3. Management/Administration
- ☐ 4. General Interest
- ☐ 5. Flight Project
- ☐ 6. Suborbital Investigation
- ☐ 7. Data Analysis
- ☐ 8. Basic Research
- ☐ 9. Advanced Planning & Mission Definition
- ☐ 10. Science Working Group
- ☐ 11. NAS/NRC Advisory Committee
- ☐ 12. NASA Advisory Council or Committee
- ☐ 13. Committee(s): _____

OSSA Involvement (check all that apply)

- ☐ 1. Astrophysics
- ☐ 2. Communications
- ☐ 3. Earth Science and Applications
- ☐ 4. Information Systems
- ☐ 5. Life Sciences
- ☐ 6. Microgravity Science and Applications
- ☐ 7. Shuttle Payload Engineering
- ☐ 8. Solar System Exploration
- ☐ 9. Space Physics
- ☐ 10. None

Discipline (check all that apply)

- ☐ 1. Astronomy
- ☐ 2. Communications
- ☐ 3. Computer Sciences/Information Systems
- ☐ 4. Environmental Observations
- ☐ 5. Life Sciences
- ☐ 6. Microgravity Sciences
- ☐ 7. Planetary Sciences
- ☐ 8. Solar and Space Physics

NASA Contractor/Grantee: ☐ Yes ☐ No

(If YES, please provide current NASA/OSSA Contract & Grant Numbers and Designate Level of Responsibility)

P - Principal Investigator
C - Co Investigator
L - Team Leader

Example
[N A G W - 1 2 3 4 5] [P]

_____ ☐ _____ ☐ _____ ☐

_____ ☐ _____ ☐ _____ ☐

Signature: _____ Date _____

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